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LANGUAGE LEARNING DISABLED STUDENTS: A STUDY OF VERBAL REHEARSAL; ATTENTIONAL PROCESSES; AND ORAL DISCOURSE NARRATIVE RECALL AND COMPREHENSION

BY

OLIVE COSSAR

A THESIS
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The undersigned certify that they have read, and recommend to the faculty of Graduate Studies and Research for acceptance, a thesis entitled: Language Learning Disabled Students: A Study of Verbal Rehearsal; Attentional Processes; and Oral Discourse Narrative Recall and Comprehension submitted by Olive Cossar in partial fulfilment of the requirements for the degree of Master of Education in Special Education.

Charles A. Norman
Supervisor

R Mulcahy

W P Browne

Date: August 30th, 1989

DEDICATION

To my family, Doug, Roisin, and Simon.

ABSTRACT

Selective attention, sustained attention, verbal rehearsal skills, and narrative recall and comprehension were explored in 20 language learning disabled students of average ability, low school achievement and a mean age of 97.05 months. Hearing was normal for all students, all scored within the average range on the WISC R and all scored below the average range on at least two composite scores on the TOLD-2 P (Newcomer & Hammill 1988).

Experimental tests of selective attention, sustained attention, verbal rehearsal, and oral discourse narrative recall and comprehension were administered. In the absence of standardized norms performance was compared with the performance of 20 regular grade 2 students, mean age 93.05 months

Significant differences in performance between the two groups were found on the test of verbal rehearsal; on the name matching condition of the test of selective attention; on errors of omission on the test of sustained attention; and in the use of complex sentences, nonreferential pronouns and comprehension on the oral narrative recall and comprehension task. Few correlations were found for the data from the standardized and experimental tests.

Results were interpreted as demonstrating that differences in performance on cognitive and linguistic tasks which are frequently found between normally achieving students and learning disabled students were also present between a population specifically defined as language learning disabled and normally achieving students. The cognitive and linguistic differences between the language learning disabled students and the normally achieving students were apparent in students as young as eight years of age. Low performance on one test of cognitive processing did not predict low performance on another test of cognitive functioning.

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1. INTRODUCTION

The origins of this study are in the author's clinical experience with language learning disabled children in the regular school setting. While the author worked as a speech language pathologist in the Edmonton Public School System, children in the early grades were referred to her by teachers for language assessments. The referred children as a general rule had difficulty achieving to the level expected of them relative to their age and grade level. They were non productive in the classroom in terms of achieving the objectives of the curriculum and teachers were concerned that a language disability might underlie the students' difficulties.

The notion that language ability is related to school achievement is not new. Twenty six years ago Carroll (1989) proposed a model of school learning which included a language component as a significant variable that related to school success. The origins of the model were in work on second language learning. Carroll (1989) observed that individuals with a low aptitude not only appeared to take a much longer time to achieve a given criterion of learning than individuals with high aptitude, but also the quality of instruction and the ability to understand instruction interfered with achievement.

From these observations Carroll postulated five basic classes of variables to account for variations in school achievement.
1) Aptitude determines the amount of time a student needs to learn a given task under optimal conditions of instruction and student motivation. 2) Opportunity to learn is the amount of time allowed

for learning by the school schedule. 3) Perseverance is equivalent to motivation and is defined as the amount of time a student is willing to spend on learning a task. 4) Quality of instruction interacts with the time needed to learn. If the quality of instruction is less than optimal then more time is needed by the student to learn a task. 5) The ability to understand instruction involves language comprehension, and the learner's ability to figure out for him-herself what the learning task is and how to go about learning it.

The fifth variable, the ability to understand instruction, addresses the concern of teachers about the language skills of the referred children. In referring students to the speech language pathologist teachers were demonstrating a concern that the students might have language disabilities which were related to the student's lack of school achievement.

The author responded to the teachers' concerns about the language skills of the referred children and provided the requested assessments and interventions. With this experience came an awareness that although teachers were requesting language assessments and interventions for the referred students, their expressed concerns about the students frequently encompassed more than language concerns. Teachers frequently described students as; "not aware of what they are supposed to do;...never paying attention...never finishing assigned work...very distractible...having a short attention span...needing to have instructions repeated...not being able to work independently."

At the same time as the author was becoming impressed with the need to address other issues related to school achievement as well as language skills, she participated in a course on the development and learning of exceptional children. The focus of the course was current theories about learning and development and how these relate to exceptional children, particularly learning disabled children. General and specific information processing theories were introduced as a framework for understanding the learning problems of exceptional children.

In information processing theories the individual is viewed as an active processor of information. The presumption is that he or she acquires knowledge through interaction with an existing body of knowledge, using specific cognitive processes. These include processes for controlling attention, for encoding information, for organizing encoded information into an internal unit, and for combining new information with previously stored information to form a new unit (Sternberg, 1980, 1984). Individual differences in learning can be traced to differences in any of these basic processes including specific cognitive strategies, metacognitive strategies or the individual's knowledge base.

In examining individual differences the focus of assessment is on the child's strategic knowledge rather than the child's accumulated knowledge. The belief is that the child independent of the teacher controls much of what is learned. Thus in order to understand how the child learns, it is necessary to understand how the child utilizes the cognitive processes that underlie performance. The cognitive processes include those that are applied directly to information and those that involve the child's awareness of the learning task and himself or herself as a learner. The child has to understand the nature of the task, where to look for information, what to focus on, what to remember, and how to remember it (Swanson & Watson, 1982).

The theoretical framework of information processing provided the impetus for further examination of cognitive processes in children referred for language assessments and interventions. In applying the information processing framework to children with language disabilities it seemed possible that deficits in underlying cognitive processes as well as language disabilities might be responsible for the behaviours described by the teachers.

The literature on children with learning disabilities provided support for this notion. Most research has centred around memory and attention processes in older learning disabled children. Learning disabled children as a group are consistently less active, planful, and organized in their approach to memory tasks (Torgesen & Licht, 1983). Learning disabled children as a group are also reported to exhibit more attentional problems than normally achieving children (Krupski 1980).

Very little research on cognitive processing appears to have been completed on children with deficits in oral language. At the same time most research on language learning disabled children seems to focus solely on deficits in language, and cognitive processes are not addressed. There also appears to have been little research involving young learning disabled children. In addition, most research has focussed on unitary cognitive processes. It is not clear if findings from studies on older learning disabled children generalize to young language learning disabled children.

The present study is designed to explore attention and memory processes, and narrative recall and comprehension in children defined as language learning disabled. Language learning disabled children are those who demonstrate an oral language deficit which is not secondary to neurological, emotional, sensory deficits, or to second language learning. They have ability levels within or above the normal range of functioning, and school achievement falls below that expected for ability and grade level.

2. REVIEW OF THE LITERATURE

This study involves an exploration of selective and sustained attention, rehearsal processes, and discourse processing and comprehension in children identified with language disorders who are nonproductive in terms of the objectives of the curriculum. The review of the literature begins with the broad topic of human information processing and includes the Piagetian model of cognitive development and Sternberg's (1980,1984, 1988) triarchic theory of intelligence. The topic then narrows to specific models of information processing concerned with rehearsal processes, attention, and oral discourse narrative recall and comprehension. Studies which compare the performance of learning disabled students with normally achieving peers on rehearsal, attentional tasks, and discourse narrative recall and comprehension are included in the review.

Human Information Processing

Cognitive psychology deals with how individuals gain information about the world, how that information is represented and transformed as knowledge, how it is stored and used to direct attention and behaviour (Solso, 1988). A whole range of psychological processes is involved, including perception, memory, attention, language, thinking, and problem solving. Each of these processes is an independent field of study in cognitive psychology. The information processing model integrates all of the processes into a larger system.

Many different information processing models exist. Some are broad and provide general guidelines for all cognition; some are specific and target behaviours such as memory, attention, and discourse processing. Whether the models are global or specific, the focus of all models is on the various processes employed by the individual in the acquisition of information and problem solving. Common to all models is the assumption that the operations for encoding and decoding information are performed in a series of stages (Solso, 1988). In each stage information is received from a previous stage and operations unique to that stage are performed on the input. In some models stages are represented as linear sequences through which information flows. In other models stages are determined by the type and/or level of processing which takes place.

The interest in human information processing in North America developed in part out of a dissatisfaction with the behaviouristic approach which dominated psychology in North America for the first half of the twentieth century (Phillips, 1981). During that time studies of mental operations such as attention, memory, and thinking, were abandoned in favour of studies on objective, observable and measurable behaviours. Typically behaviourists viewed learning as the result of classical conditioning and/or environmental contingencies. The freedom of the individual to actively chart his or her own learning was not acknowledged.

In the 1950's psychologists began to focus once more on cognitive topics such as attention, memory, and language processes. Behaviouristic systems were unable to account satisfactorily for the complex processes involved in these topics and as a result cognitive psychology was developed (Solso, 1988). About the same time Piaget's work on the development of cognitive processes in children, which had been published in Europe since 1927, (Phillips, 1981) found its way to North America.

Piaget's Theory of Cognitive Development

The Piagetian theory of cognitive development provides the foundation for many information processing models. One of Piaget's major concerns was with the development of cognitive structures. Piaget was interested in how children adapt to their environment and how through the process of adaptation they develop cognitive structures and become intelligent beings.

Piaget posited that the child is an active organism who constructs his or her own knowledge of reality through active engagement with the environment (Furth, 1981). Just as a biological organism adapts to its environment, so the child constructs his or her knowledge of the environment by adapting to the objects and events in the environment. The process of adaptation depends on two invariant functions which act reciprocally; assimilation and accommodation.

Assimilation is the process whereby the child adapts the environment to biological structures which are already in existence. Accommodation results in the modification of an assimilatory scheme by the elements it assimilates. A change occurs in the child's biological structures manifested in a new schema for acting on the environment. Piaget proposed that the functional invariants of assimilation and accommodation acting reciprocally resulted in adaptation. Adaptation resulted in intelligent functioning.

The processes that Piaget believed underlie adaptation and the development of intelligence have been incorporated into many models of information processing. Sternberg's (1980, 1984) triarchic theory of intelligence is one particular model of information processing which incorporates Piaget's constructs of assimilation and accommodation to explain how new knowledge is acquired.

Sternberg's Triarchic Theory of Intelligence.

Sternberg's (1980, 1984, 1988) triarchic theory of intelligence is a theory of intelligence based on an information processing framework, thus it is appropriate to examine it as part of the present study. The theory is an example of a global model of information processing but unlike most information processing theories which are concerned only with internal processes the triarchic theory deals with the internal and external world of the individual. In this theory Sternberg (1980, 1984) posits the processes which he believes underlie intelligent functioning as well as the contexts in which intelligent behaviour occurs. The model is composed of three subtheories; a contextual subtheory, a two-facet subtheory and a componential subtheory.

The Contextual and Two-Facet subtheories

The contextual and two-facet subtheories are not the major focus of this study and so only a brief description is necessary at this time. The componential subtheory is relevant to the study and a more detailed description will follow.

The contextual subtheory relates intelligence to the external world of the individual and specifies the context in which intelligent behaviour occurs (Sternberg, 1984). Central to Sternberg's model is the notion that intelligent functioning is in part related to how the person adapts to real-world environments (Sternberg, 1984). Sternberg (1980, 1984) specified three classes of acts that characterize intelligent functioning in the everyday world. Adaptation occurs when the individual tries to achieve a good fit between him- herself and the environment. If adaptation does not result in a better fit the individual might attempt to achieve a better fit by shaping the environment. When neither adaptation nor shaping results in a better fit, the individual might attempt to select another environment where there is the possibility of obtaining a good fit.

The second subtheory of the triarchic model of intelligence is the two-facet subtheory. Here, Sternberg (1984) specifies the tasks or situations that most critically involve the use of intelligence. Sternberg (1984) proposed that tasks measure intelligence to the extent that they require either or both of two skills; the ability to deal with novel tasks and the ability to automatize information processing. Tasks encountered in real-world environments vary along a continuum from the very familiar to the novel. Different allocations of attention are necessary depending on where the task falls along the continuum of novel to familiar. When a task is new the individual has to apply skills for coping with novel situations;

processing in this instance is controlled by the individual. When the task becomes familiar with practice, there may be a shift from controlled processing to automatic processing. Resources are then freed for allocation to other tasks or portions of the task.

By including these two subtheories within an information processing framework Sternberg departed from the traditional focus on internal operations espoused by most information processing theorists. His third subtheory, the componential subtheory returns to the traditional focus on internal operations and relates intelligence to the internal world of the individual. The componential subtheory is more relevant to the present study than either the contextual or two-facet subtheories. In the componential subtheory Sternberg (1980, 1984, 1988) specifies the mental mechanisms that lead to intelligent behaviour.

Sternberg's Componential Subtheory

In the componential subtheory the mental mechanisms which underlie intelligent behaviour are components which operate upon internal representations of objects or symbols (Sternberg, 1980). Components are thus comparable to control processes described in other information processing models. Sternberg (1980, 1984, 1988) believes that components perform at least three different kinds of functions. 1) Metacomponents are higher order processes used in planning, monitoring and decision making. 2) Performance components are lower order processes used in the execution of tasks; and 3) knowledge acquisition components are the components used in learning new things (Sternberg, 1984).

Functions of the metacomponents.

Metacomponents are the highest order components. These are the executive processes which plan, monitor, and evaluate the task performance of the other components. As executors they are in charge of directing and coordinating the other components. They are the only components that can act on other components, and the only components that do not deal directly with data themselves.

Sternberg (1984,1988) posited eight metacomponents he believed to be the most important for intelligent functioning. First in a) recognizing that a problem exists, and b) recognizing the nature of the problem, the individual must be able to figure out that there is a problem and what that problem is. Sternberg (1984, 1988) proposed that the metacomponents then, c) select a set of lower order non executive components for performance of the task. Selecting the wrong components at this stage will result in errors. Having selected the right components, the individual must then d) select a strategy which will result in the appropriate sequencing of the lower order components.

The metacomponents are also responsible for e) selecting one or more mental representations for the information. A given component can operate on any one of a number of different possible representations thus a selection has to be made by the metacomponents. In some instances the choice of representation is mandated by the task. In other instances various forms of representation are possible. If there are choices, the representation should match the individual's strengths. For example some students have stronger spatial than verbal skills. If there is no choice the metacomponent should choose the representation mandated by the task.

The metacomponents also f) decide how to allocate attentional resources. In deciding how to allocate resources the metacomponents need to take into account the nature of the task. "Easy" tasks usually demand less effort from an individual and thus less time should be allocated to them than to "difficult" tasks. Metacomponents also g) monitor and keep track of the individual's place in task performance. It is important to recognize whether a chosen strategy is failing or working when the task is in progress, so that modifications in performance can be made before it is too late. The metacomponents are also h) involved in understanding internal and external feedback, and in recognizing the implications of feedback for enhancing performance. This is particularly relevant in the school context where learning initially depends on corrective feedback from teacher to student.

Functions of the performance components.

Performance components, the second subgroup of components in the componential subtheory, function when familiar tasks are being performed. They are lower order components, and act only on the direction of the metacomponents. Sternberg (1980, 1984) suggests that there might be large numbers of them, many of which are applied in small subsets of tasks. Of more interest to this study are the groups of performance components which appear to have broad applicability across tasks. These are used during the a) encoding of stimuli, b) combination or comparison between stimuli and c) response (Sternberg, 1984).

1. Encoding. Sternberg (1980) notes that in any problem solving situation, the terms of the problem must be encoded and stored in working memory while long term memory is searched for information related to the problem. Relevant information from long term memory is then placed in working memory.

2. Combination or comparison between stimuli includes processes such as (a) inferring relations among stimuli, (b) applying previously inferred relations to new situations, (c) mapping higher order relations between relations, (d) comparing alternative solutions and deciding which is the best solution to a problem (Kolligian & Sternberg, 1987). These are the components which are used in reasoning tasks.

3. Response. In response, an individual communicates a solution to a problem.

Functions of the knowledge acquisition components

Knowledge acquisition components are the third subgroup of components that make up the componential subtheory. While the performance components are used in carrying out familiar tasks, knowledge acquisition components are utilized in learning new information. Like performance components these are also lower order non executive components which come under the direction of the metacomponents. Sternberg (1980, 1984) proposed three main knowledge acquisition components; selective encoding, selective comparison, and selective combination.

1. Selective encoding involves sifting out relevant from irrelevant information and recognizing in the midst of new information what is relevant to fulfill the purpose of the task. An

example is the student who gathers information for a report. All of the information available on the topic will not be relevant to the specific topic therefore the student has to make a decision about which pieces of information to retain and which to discard.

2. Selective combination involves putting together the selected information, assimilating it, and organizing it to form a usable and coherent cognitive structure. This is necessary because selecting information for encoding is not sufficient to generate a new knowledge structure. The individual must have some means of combining this information into an internally connected whole (Sternberg, 1984).

3. Selective comparison involves relating newly acquired to old and previously stored information so as to form a new and intergrated whole.

Sternberg (1980, 1984) modelled the selective combination component on Piaget's construct of assimilation. The selective comparison component was modelled on Piaget's construct of accommodation.

Although Sternberg's (1980, 1984) componential subtheory provides a comprehensive account of the possible components which underlie intelligent functioning it does not provide specific information in areas of attention, memory, and discourse processing which are the focus of this study. Specific models of information processing provide more information about these processes.

Introduction to Specific Models of Information Processing

In the interests of parsimony specific aspects of information processing became the focus of this study. The processes which were chosen reflected what the literature said about characteristics of learning disabled students as well as the author's experience with language learning disabled students.

Memory was chosen because memory problems are frequently cited as a characteristic of learning disabled students in the literature on learning disabilities (Torgesen, 1981) and by teachers of learning disabled students. Memory tasks involve three processes; encoding, storing, and retrieving information (Torgesen, 1981) and problems can occur in any or all of these processes. Within the constraints of this study it was not possible to examine all of these processes and so only verbal rehearsal was identified for further exploration. Verbal rehearsal at the encoding stage of processing appears to be fundamental to all other memory processes.

Attention was chosen as a second area for examination because attentional problems are another frequently cited characteristic of learning disabled students (Krupski, 1986). The construct of attention is one of the most difficult to understand in the literature on cognition. In part, this is because attention is a hypothetical construct about which there is much disagreement, and as a result there is no universally agreed upon definition (Fry & Lupart, 1987). Terms such as "distractible", "impulsive", "perseverative", "short attention span" (Keogh & Margolis, 1976a) are used frequently to describe children with difficulties in attention. These are global terms which do little to clarify the nature of the attentional problem.

Two common components of attention which are found in much of the literature are selective and sustained attention (Krupski, 1986). Because these dimensions of attention appear to be a unifying thread throughout the literature they were chosen as a focus for the present study. Models of attention were examined.to provide a basis for understanding the constructs of selective and sustained attention.

Oral discourse narrative recall and comprehension were also chosen as a focus of the study. In terms of information processing models, oral discourse narrative recall and comprehension fit under the rubric of schema theory. The focus in this study will be on how schemata actively assist recall and comprehension (Rumelhart, 1980).

The linguistic skills of children are frequently included in the study of oral narrative discourse skills. Because children with deficits in linguistic skills are easily confused with children who have memory and/or attention problems linguistic skills were also targetted in the study. deHirsch (1981) describes the child who enters grade one with a diffused and undifferentiated linguistic intake. This child is frequently not interested in verbal activities and often seems to be unable to follow a story line. deHirsch (1981) goes on to describe the impact on the child of being required to process more complex language than he or she is able. The child who is not ready to understand complex language in the first grade will retreat from listening and, in effect, learn not to listen at an early age. Thus, children with language disabilities who retreat from listening are easily confused with children with memory and attention problems.

In the following sections the focus will be on verbal rehearsal, selective attention, sustained attention, oral narrative recall and comprehension. Specific information processing models relevant to each of these areas will be examined. As well, studies comparing learning disabled students to normally achieving students in each of these different areas will also be cited.

Verbal Rehearsal

Verbal rehearsal appears to be fundamental to other memory processes. Much of our information about verbal rehearsal has come from two specific models of memory. In the multi store model of memory (Atkinson and Shiffrin, 1968, 1971) verbal rehearsal is introduced as an essential process in memory. The levels of processing model (Craik & Lockhart, 1972) builds on the multistore model by focussing more on the elaborative processes which are made possible by the maintenance of information through rehearsal.

The Multi Store Model of Memory.

Atkinson and Shiffrin (1968, 1971) proposed that there are two dimensions to memory. Memory consists of structural features both psychological and neurological which cannot vary. Memory also consists of control processes which can vary and which are selected and used at the option of the individual. Verbal rehearsal is one of the control processes which is used at the option of the individual. Atkinson and Shiffrin (1968, 1971) also proposed that there are three components to memory; the sensory register, the short term store and long term store. The short term store is the most relevant to the present study because the verbal rehearsal processes are active there. A brief overview will be given of the sensory and long term stores and more emphasis will be placed on the short term store component.

In the sensory register a decision is made about which sensory register to attend to, and where and what to scan. Information remains in the sensory register for a brief time only before decaying or flowing on to short term store.

The short term store also known as working memory (Atkinson & Shiffrin, 1971) is the heart of the model. "decisions are made, problems are solved and information flow is directed" (Atkinson & Shiffrin, 1971, p. 83). However, the efficiency of the short term store to fulfill these functions is reduced because it has a limited capacity. It can deal with only seven plus or minus two items at one time (Miller, 1956) and unless efforts are made to maintain information in short term store it decays within 15 to 30 seconds.

Rehearsal processes increase the efficiency of the short term store by increasing the length of time information is available for processing. When information is available in short term store the control processes have an opportunity to organize the information into chunks rather than single units of information. This serves to increase the storage capacity of the short term store. Verbal rehearsal also facilitates the transfer of information from short term to long term store.

Long term store appears to have unlimited capacity and permanent storage in contrast to the limited storage available in the sensory register and short term store. Atkinson and Shiffrin (1968, 1971) did not clearly differentiate types of knowledge stored here; semantic information appears to be dominant, but other sensory modalities are also represented.

The Levels of Processing Model of Memory.

The progressively greater part played by the control processes (Atkinson and Shiffrin 1971) led to an increased focus on the encoding processes and the depth to which information is processed. Craik and Lockhart (1972) proposed that memory is best viewed as a continuum of analyses which proceed from the analysis of a series of sensory stages, to levels associated with matching or the recognition of patterns, to semantic-associative stages of stimulus enrichment. The major factor in retention is the depth of analysis an item has received and not the transfer of information from short term to long term store.

Rehearsal processes play a significant role in making information available for analysis, and in the type of analysis which takes place. Craik & Lockhart (1972) proposed two types of rehearsal processes; maintenance rehearsal and elaborative rehearsal. Type 1 processing is a maintenance type of rehearsal similar to that proposed by Atkinson and Shiffrin (1968, 1971). The function of maintenance rehearsal is to maintain a memory image and further processing does not take place as long as the information is retained in this "holding state" (Norman 1976, p.126). Maintaining the image provides an opportunity for Type 11 rehearsal to occur. Type 11 rehearsal is an elaborative rehearsal which increases the retrieval strength of the stimulus. Elaborative strategies which can be used include grouping, clustering, categorizing the stimuli, attention to critical elements, imagery, spatial position, and organization (Butler, 1984).

Verbal Rehearsal Skills and Learning Disabled Students

Rehearsal skills are frequently studied in the normal population using free recall tasks. In free recall tasks, a list of items is presented and then recalled in any order by the participant. The memory for the first and last items presented are attributed to two different memory processes. Recency items, the last few items presented are believed to be retrieved from immediate short term store but primacy items, those presented first, are believed to be retrieved from long term store. Scores for primacy items recalled are used to judge the presence of verbal rehearsal skills (Bauer, 1977).

Tarver, Hallahan, Cohen & Kauffman (1977) reviewed studies of verbal rehearsal in the normal population and found that verbal rehearsal skills increased with age in normal learners. Results of the studies indicated that adults demonstrated both primacy and recency effects but children did not show primacy effects until they reached a mental age of about eight years. Failure to demonstrate primacy effects suggested that young children did not use adequate verbal rehearsal strategies. Tarver et al. (1977) reported that spontaneous use of verbal rehearsal increased with age between kindergarten and fifth grade.

Empirical findings indicate that learning disabled students differ from normally achieving students in the use of verbal rehearsal skills. Tarver, Hallahan, Kauffman, and Ball (1976) demonstrated that although eight year old normally achieving children demonstrated both primacy and recency effects on Hagen's Central-Incidental task, a serial recall task, eight year old learning disabled students demonstrated a recency effect only. Failure of the learning disabled students to demonstrate a primacy effect suggests that they were not rehearsing. When 10 year old and 13 year old learning disabled students completed the same task they exhibited both primacy and recency effects. The results suggested that verbal rehearsal skills improved with age in the learning disabled population as well as in the regular population.

In another experiment involving young subjects (Torgesen & Goldman, 1977), second grade students identified as poor readers were compared with second grade good readers on a delayed sequential recall task of pictures. Recall was tested using a pointing response thus ensuring that the use of verbal strategies was not mandated by the task. The good readers had a higher level of recall and were also observed to verbalize more during the task. Verbal rehearsal was estimated from the amount of verbalizations used by the students.

In a second study the task was varied by the imposition of a verbal rehearsal condition. The same children as in the previous study were requested to point as well as name the pictures to be remembered both during the presentation and recall phases of the task. The enforced use of a verbal rehearsal strategy resulted in no differences in recall between the groups. Torgesen and Goldman (1977) interpreted the findings as support for the hypothesis that deficits in short term memory functioning reflect a failure to actively engage efficient rehearsal strategies.

Torgesen (1977) found further support for this position in a study involving older students. The performance of grade four reading delayed and normally achieving students was compared on category recall and ordered recall under a no instruction condition and an instruction condition. There was a significant difference in the amount of recall between the groups on both of the tasks when no instruction was given, with the reading delayed groups recalling significantly less than the normally achieving group. When the students were given instruction in strategies to use during the task and were reminded to apply the strategies when the task was in progress there were no differences between the groups in the amount recalled.

In an experiment employing older students Bauer (1977, 1979) demonstrated that learning disabled students identified on the basis of an achievement, ability discrepancy, had an intact short term store but did not use verbal rehearsal skills appropriately. Bauer (1977) compared the performance of twelve 10 year old learning disabled and normally achieving students on a word repetition task. Recall conditions were varied by imposing time delays and no time delays, with and without an intervening counting task. The normally achieving group was superior to the learning disabled group regardless of whether the delays were filled or unfilled. In the immediate recall condition, the learning disabled group showed deficits in primacy recall relative to the normally achieving control group but recency recall was similar for both groups. In the delayed recall task both primacy and recency effects of the learning disabled were poorer than those of the nondisabled. In the delay-filled condition the normally achieving group remained superior on primacy indicating the continued use of verbal rehearsal, but the recency recall of both groups was similar.

Bauer's (1977) findings supported the position that the recall differences between the normally achieving and learning disabled students were not due to differences in short term store, but to differences in the use of verbal rehearsal processes.

The findings were supported in a second experiment (Bauer, 1977) in which the length of the word list was manipulated. Learning disabled and normally achieving students did not differ in their immediate recall of a three word list, indicating that they both attended to items in immediate memory. When a delay was imposed on recall and rehearsal was necessary to maintain the words in memory, the normally achieving students were superior to the learning disabled students. When the lists were increased in length, the groups did not differ in recency recall under an immediate recall condition, but the normally achieving students were superior in primacy recall. Under delayed conditions, the normally achieving group evidenced use of rehearsal and the learning disabled group did not. Both primacy and recency effects of the normally achieving group were superior to the learning disabled group.

Summary of verbal rehearsal.

1. Verbal rehearsal is one of the control processes which functions in working memory. Like the other control processes it can vary, and it is under the control of the individual.

2. Verbal rehearsal functions to maintain information so that further processing can take place. If information is not rehearsed it decays rapidly and no further processing is possible.

3. Verbal rehearsal provides the opportunity for the application of elaborative rehearsal processes which result in an organized and strong memory trace.

4. Verbal rehearsal facilitates the transfer of information to long term store.

5. Verbal rehearsal skills increase with age in normally achieving students. Young children do not show primacy effects until they reach a mental age of about eight years.

6. Learning disabled students demonstrated primacy effects at a later age than normally achieving students.

7. Differences between normally achieving students and learning disabled students in the active engagement of verbal rehearsal skills were demonstrated in both young students and older students indicating that older learning disabled students may continue to be deficient in the use of verbal rehearsal.

8. The studies supported the notion of a deficit in verbal rehearsal skills and not a deficit in short term store.

Selective and Sustained Attention

In general, attention is concerned with how individuals limit and select the information they process (Norman, 1976). This is necessary because humans have a limited capacity for processing information and cannot deal with all that is available to them. Only a small portion of information is selected and processed in order to protect the system from being overloaded. Somewhere in the process a limit is put on the amount of information that is selected for further processing. The study of the phenomenon of attention is the study of this limitation and selection (Norman, 1976). Selective attention refers to the processing of some environmental stimuli at the expense of other stimuli (Samuels & Edwall, 1981). Sustained attention refers to the ability to sustain attention to the selected stimuli over a period of time.

The most popular explanations of how information is selected and limited are filter models and capacity models of attention. Recently a number of psychologists have also proposed a cognitive approach to selective attention (Lupart & Mulcahy 1984).

Filter and Capacity Models of Attention.

Broadbent's (1958) filter model of attention was the first attempt to describe the role of attention within an information processing framework (Fry & Lupart, 1987). Broadbent (1958) proposed that input is selected and limited through the action of a filtering mechanism. Only one sensory input can be analyzed at a time. When more than one stimulus arrives at the brain, one is analyzed and the remaining messages are held momentarily in temporary storage. If these messages have not decayed by the time perceptual analysis has been completed on the first stimuli they are then analyzed. Information is thus processed sequentially with the analysis of the second piece of information occurring only after the first piece has been analyzed.

Treisman (1964) modified Broadbent's (1958) model by proposing that all incoming messages succumb to a hierarchy of tests. Several stimuli are analyzed simultaneously and only those which are contextually appropriate or important are attended to. Norman (1976) proposed that selection of information for processing is based on meaningful material. All information is initially matched to information in long term memory and given an initial simple analysis for meaning. Relevant information is then selected for further processing.

The difficulty with filter models is that they do not promote the active role of the individual in limiting and selecting information. The focus is a bottom-up approach to processing. Bottom-up processing starts with the data and continues with increasingly more sophisticated levels of analysis until the final recognition of the input (Norman, 1976).

In capacity models of attention the concern is with how the deployment of attentional resources limits information available for processing. Kahneman (1973) proposed that attention is a limited resource and so the amount that is available for deployment at any time is limited. Because attention can be deployed among several concurrent activities (Lupart & Mulcahy, 1984) the successful execution of these activities depends on the demands the activities put on the limited capacity processor. A task which is easy for the individual demands little effort and a difficult task demands more effort.

Performance can suffer if the task is too difficult and there is not enough attentional capacity to meet the task demand. Or performance can suffer if attention is allocated to other activities and there is not enough for the current task. In addition, performance can be adversely affected when there is insufficient input of relevant information such as when the teacher's voice in the classroom is masked by background noise (Kahneman, 1973).

Cognitive Models of Attention.

In the cognitive approach to attention, limits to processing are viewed as cognitive limitations and not as structural and capacity limitations (Lupart & Mulcahy, 1984). The emphasis is on the relationship between attentional processes, cognition, and cognitive development. Gibson and Rader (1979) proposed that increases in attention apparent from infancy to adulthood are not structural changes but cognitive changes. The individual's perception changes with increasing self knowledge and knowledge about the world. As a result he or she becomes more adept at picking up information which is relevant to the task at hand.

Krupski's (1980) model is relevant to the present study. Krupski (1980) proposed an interactive model of attention in which the characteristics of the child interact with the demands of a given task. Thus attention is not viewed as a static attribute cf an individual, and attentional problems are not accepted as an inherent characteristic of a child. Instead, the ability to select appropriate information and to sustain attention varies from task to task depending on the nature of the task and the characteristics of the child.

Krupski (1980) views attention along two dimensions: voluntary and involuntary attention, and sustained and short term attention. Voluntary and involuntary attention concern the volitional control of attention by the individual. Involuntary attention is demonstrated in situations where attention is elicited directly by a stimulus, thus it is externally controlled rather than being monitored internally. In contrast, there is a strong volitional component to voluntary attention; attention here is internally and intentionally controlled by the individual and requires effort for maintenance. Sustained and short term attention reflect the temporal aspects of attentional deployment. Sustained attention can last for several minutes and/or hours but short term attention lasts only a matter of seconds.

The type of task to which attention is given is a critical element in examining attention (Krupski, 1980). Tasks can be distinguished on the basis of the degree of voluntary attention required. Those which require long vigils in order to respond appropriately make rigorous demands on voluntary attention. School tasks vary on the degree of attentional control necessary. Challenging school tasks require maintenance of attention for extended periods of time and thus require more volitional control than less demanding tasks. In contrast, when the task involves watching fast paced action shows on television very little voluntary control is required from the individual. Attention is "captured" in this instance

Task difficulty also seems to affect how children attend. Krupski (1985) found that the attention of children described as "learning handicapped" (p. 52) varied with the cognitive demands of the task. The least amount of attention to task was evidenced when the cognitive demand was the greatest.

Child characteristics also are a critical variable in attention. It is self evident that the resources a child brings to a task will likely influence his or her performance on that task. Thus one could predict that a child with a language learning disability might have difficulty selecting relevant from irrelevant information in language based tasks.

Selective Attention and Learning Disabled Students.

There are two popular methods for studying selective attention. One involves the use of Central-Incidental tasks and the other, studies of distractibility. Central-Incidental tasks which are based on Broadbent's (1958) filter theory of attention have come under attack recently for confusing attention with memory (Fleisher, Soodak and Jelin, 1984; Krupski, 1986) and for this reason they were not included in the review of the deficits in selective attention. The focus is on studies of distractibility.

Distractibility is defined as the "differential deterioration in task performance...in the distraction as opposed to the non distraction condition" (Douglas & Peters 1979 p. 181). There must be a demonstrated deterioration in task performance when distractors are present. Deterioration occurs because attention is not focussed on stimuli relevant to the activity or event, instead irrelevant stimuli are processed.

Distractibility is frequently inferred from scores on the WISC R. Scores on the Digit Span, Arithmetic, and Coding subtests make up a Freedom from Distractibility factor (Sattler, 1988). Interpretation of the Freedom from Distractibility is based on a number of processes that may underlie performance. For example a low Freedom from Distractibility score suggests "difficulty in sustaining attention, distractibility, anxiety, short term retention deficits, encoding deficits, poor rehearsal strategies, difficulty in rapidly shifting mental operations on symbolic material, and inadequate self monitoring skills" (Sattler, 1988, p. 174). There are so many possibile cognitive bases to the deficits inferred by scores on the factor that its use as a measure of distractibility is questionable.

Krupski (1986) in a review of studies on distractibility identified three classes of distractors, distal, proximal, and embedded, which differentially affected the performance of children classified as learning handicapped. The learning handicapped classification (Krupski, 1986) included learning disabled children and children with other etiologies. The focus in this study is on the learning disabled group. The fact that performance varied with the type of distractor indicated that distractibility was not an inherent characteristic of the children.

Distal distractors, those at some distance from the task, had no adverse effect on the performance of learning handicapped children.

Under some conditions proximal distractors, those easily distinguished from the task but in close proximity to it, affected their performance. Samuels (1967), in a study which employed young students, found that grade one underachievers in reading were adversely affected by pictures accompanying a reading text compared with normal readers. Grade one children were required to read a story containing 50 different words in a picture, no-picture condition. Good readers recognized 40 of the 50 words to be learned regardless of whether the text was illustrated or not illustrated. Poor readers learned to read significantly fewer words in the picture as opposed to the no-picture condition. The pictures acted as a distractor for the poor readers only, with the result that they learned fewer words from a text when there were pictures in it than they did when there were no pictures. The good readers were not affected by the pictures.

Under some conditions embedded distractors also affected performance. Using a speeded classification task Copeland and Wisniewski (1981) required learning disabled children with a mean age of 122.65 months and non disabled children, mean age 121.4 months to sort decks of 24 cards on the basis of a single attribute. Each deck was marked with one to three irrelevant features as well as the critical stimulus. Sorting errors, and the number of features factor in relation to sorting time, were measured. The children with learning disabilities made more errors and took longer to sort their decks than normally achieving students. In a replication study (Copeland and Reimer, 1984), the learning disabled students did not make more errors than the normally achieving group but they did take longer to sort the cards. The difference between the groups was restricted to the time taken to complete the task. The results suggest that the ability to process information quickly was the differentiating factor between the groups.. The learning disabled students may have had difficulty with speed of processing rather than difficulty with attending selectively (Copeland & Wisniewski, 1981).

Sustained Attention and Learning Disabled Students

Vigilance tasks are frequently used to assess the ability to sustain attention in laboratory type settings. They require the continuous monitoring of a monotonous stream of either auditory or visual stimuli for an extended period of time (Krupski, 1986). Participants respond only to previously identified critical stimuli interspersed randomly among the stimuli. Attention is not directly controlled by the stimuli, instead it is under the voluntary control of the person, thus vigilance tasks are metacognitive tasks and an indirect measure of the voluntary control of attention.

Specific metacognitive processes regulate attention during vigilance tasks. Regulation involves an awareness of task demands, the ability to monitor performance, and knowledge about when the task is complete (Krupski 1980).

Vigilance studies are frequently reported in terms of omission errors, decrement in performance, and errors of commission. There is empirical evidence that learning disabled children make more errors of omission than normally achieving children. Doyle, Anderson, and Hallcomb (1976) reported that learning disabled children aged 8 to 12 years made more omission errors than normally achieving students on a 30 minute discrimination task with visual distractors. Similar findings were reported by Keogh & Margolis (1976 b). The performance of 73 educationally handicapped boys from grade three through grade eight was compared with the performance of 78 matched normally achieving boys on a series of measures designed to test three components of attention; coming to attention, decision making, and maintaining attention over time.. The educationally handicapped category is a special education classification category used in California to define children with at least average IQ level who are functioning below grade level, and whose learning impairment is associated with signs of neurological impairment, mild emotional disturbance, or severe behaviour disorders (Keogh & Margolis, 1987 b). On a test of vigilance measuring the ability to maintain attention, the educationally handicapped groups consistently made more errors of omission across all age groups compared with the performance of the normally achieving groups.

Swanson (1983) reported similar findings for learning disabled boys aged 8, 10, and 14 to 15 years. The learning disabled boys at all age levels consistently made more errors of omission than normally achieving boys on a Continuous Performance Task for three task lengths (5, 10 and 15 minutes). The difference in error scores was recorded for both auditory and visual modalities.

Decrements in performance on sustained tasks are also reported for learning disabled children. Keogh and Margolis (1976 b) found that the performance of educationally handicapped boys deteriorated more than the performance of normally achieving children from the beginning to the end of a vigilance task measuring the ability to maintain attention over time.

Commission errors are also reported more frequently for children with learning handicaps including learning disabled children, than they are for normally achieving children (Krupski, 1980). However, there is a lack of agreement among researchers about which diagnostic category of children evidences commission errors. Doyle et al. (1976) and Douglas and Peters (1979) found that commission errors were more prevalent in groups of children with hyperactivity. Swanson (1983) examined vigilance performance in a group of learning disabled students who were not hyperactive and found that they demonstrated commission errors. Keogh and Margolis (1976 b) and Prior & Sanson (1986), found no difference between hyperactive and non hyperactive groups on commission errors. Keogh and Margolis (1976 b) subdivided the educationally handicapped group into a hyperactive and nonhyperactive group. There was no significant difference between the groups for commission errors.

Summary of selective and sustained attention.

1. In general, attention is concerned with how information is selected and limited for processing.

2. Filter and capacity models deal with structural limitations on the amount of information that enters the human information processing system.

3. Cognitive models deal with cognitive limitations to attention.

4. Krupski (1980) proposed that task variables and child characteristics interact along the dimensions of voluntary, involuntary attention on the one hand, and the temporal dimensions of sustained attention and short term attention on the other hand.

5. Learning disabled children were shown to respond differentially to different types of distractors on tests of distractibility. No group of learning disabled children was found to be equivocally distractible on all tasks.

6. Differences in the time taken on a test of distractibility may have been due to slower processing in learning disabled students.

7. Deficits in distractibility are sometimes inferred from scores on the Freedom from Distractibility factor on the WISC R. This appears to be a global measure of many processes and is a questionable measure of selective attention.

8. Performance on vigilance tasks demands a high degree of voluntary attention.

9. Learning disabled children were found to make more errors of omission on vigilance tasks than normally achieving students.

10. A decrement in performance was reported for a group of children with average ability but below grade level achievement on a vigilance task relative to the performance of normally achieving children.

11. In general, more commission errors have been reported for learning disabled children on vigilance tasks than for normally achieving children. There is a lack of consensus about whether commission errors distinguish between learning disabled and hyperactive students.

12. Some researchers equate a high incidence of commission errors with impulsivity.

Narrative Recall and Comprehension

Historically language skills have been evaluated at the word or sentence level and the focus has been on how children process words and/or sentences. The shift to the examination of discourse processes has focussed attention not just on linguistic knowledge but also on how sentences relate to one another and to the larger text. A broad spectrum of developmental processes is involved including memory, cognition, and social cognition, as well as linguistic knowledge (Feagans, 1983). There is a growing body of empirical evidence which suggests that problems with discourse processes may have more relevance for performance in the classroom than deficits in discrete linguistic forms (Feagans, 1983).

Narrative recall and comprehension fall under the domain of discourse processing. Discourse processing includes almost all teacher instruction, conversations, story generation, story recall, and the recall of events and ideas in both the written and oral form. Most language in the oral and written form encountered in school can be classed as discourse. For the purposes of this study the focus was narrowed to include only the ability to recall and comprehend oral narratives.

The processes involved in narrative recall and comprehension are understood best when they are viewed within the framework of schema theory. Therefore an understanding of schema is basic to an understanding of narrative recall and comprehension. To this end, an overview of Rumelhart's (1980) concepts of schemata will be presented. Following this the specific nature of discourse will be presented. Because discourse narrative skills also include linguistic skills as well as broader types of schematic knowledge, traditional studies will be presented which examine linguistic skills of learning disabled students at the sentence level. Studies will also be presented comparing learning disabled and normally achieving students on narrative recall and comprehension.

Schemata

Rumelhart (1980) proposed that knowledge at all levels of abstraction is stored in the form of units called schemata (singular schema). According to Rumelhart (1980), a schema theory is basically a theory about knowledge; about how knowledge is represented and about how the representation facilitates the use of knowledge in processing information.

The units or schemata might represent abstract ideas such as knowledge about the structure of narrative, knowledge about the structure of language, word meanings, phonemic analysis, or the units might represent concrete knowledge. All units, regardless of whether they represent abstract or concrete concepts, contain knowledge about the concept in terms of normal events, situations, and interrelations that typify the concept. The units also contain information about how the concept is to be used. The implication is that schemata are active processes.

Rumelhart (1980) believes that schemata play two major roles: They assist in comprehension and they assist in the recall of information. Schemata guide remembering in two ways. First, what is remembered and stored is an interpretation of an event or text rather than the actual phenomenon. The mental representation that is constructed and stored in memory is based on an interaction between the incoming information and the schemata the person has already developed (Snyder & Downey, 1983).

Secondly, schemata are involved in the reconstruction of the original interpretation. When information is to be recalled only memorial fragments of the original information persist. The longer the time between presentation and recall the fewer the memorial fragments available (Rumelhart, 1980). At the time of recall the individual relies on his or her generic knowledge of the topic. The better the individual's knowledge about the topic the more information will likely be recalled.

In processing a narrative, when an individual listens to the story he or she evaluates the goodness of fit between his or her existing schemata and the narrative. If the particular narrative fits the processor's schemata, then that schemata can be used both to understand and remember the story (Synder & Downey, 1983).

Children develop schemata through repeated experiences with stories (Snyder & Downey, 1983). As a result of hearing stories frequently they store knowledge about story patterns. They also store knowledge about familiar events and situations through repeated experiences with them (McCarthey & Nelson, 1981). On the basis of this stored knowledge children learn to expect certain events and story elements in oral narratives. Story schemata and scriptal knowledge interact with the structure and content of the narrative to assist comprehension and recall.

Discourse processes

The story schemata that children develop are known as story grammars. Story grammars specify the internal structure of a story including the components of the story and the set of rules underlying the order and relationships among the story components (Stein & Glen, 1979, Roth, 1986). In a typical story grammar there is a setting category, and an episode category which can be subdivided into seven story grammar categories. These include an internal response, a plan, an attempt,a consequence and a reaction (Stein & Glen, 1979).

Propositions and cohesive devices are narrative features that contribute to the coherence of an oral or written text. Propositions are the speaker's idea units within a text (Clark & Clark, 1977). Cohesive devices are linguistic elements which serve to tie the text together, relating elements of the text to each other and to the whole (Ripich & Griffith, 1988). Most of the studies which examine narrative discourse focus on story grammar analyses and /or measures of propositions, cohesive devices, and linguistic elements.

Traditional studies of language learning disabilities.

Few studies were found in which the language skills of younger language learning disabled students were compared with the language skills of younger normally achieving students. Much of the work in this area appears to have involved older elementary school age children or adolescents.

Wiig and Semel (1980) through clinical observation and research with the language learning disabled noted the presence of two typical cognitive-linguistic behaviours in language learning disabled students. They frequently demonstrated word finding difficulties and they had difficulty with the syntactic and morphological subsystems of language. Syntax refers to sentence structure as in word order, inflections and the relationships between words. Syntactic rules specify which string of words are acceptable and which are not. Morphology is the study of words and their meaningful units such as roots, prefixes, suffixes, and the rules for forming words out of morphemes (Mc Cormick & Schiefelbusch, 1984). Word-retrieval difficulty is generally defined as the inability to call up intended words from a stored lexicon (Wiig & Caplan, 1984); the lexicon in this instance refers to a speaker's mental dictionary.

In a comprehensive study which explored both syntactic abilities and word retrieval skills in older students Wiig and Semel (1975) compared the accuracy and speed of semantic production, sentence formulation, and word defining abilities in 32 learning disabled and 32 normally achieving adolescents ranging in age from 12 to 16 years. The battery of tests included, the accurate naming of antonyms, retrieving verbal labels in response to pictures, rapid naming of as many members within a class as possible within 60 seconds, and formulating grammatical sentences from a given stimulus word. Conversational speech was analyzed for grammatical form, phrase length, and word finding ability.

Results confirmed significant differences between the learning disabled and normally achieving adolescents on most measures. The normally achieving adolescents used structurally varied sentences, with an average of 10 to 12 words in the longest sentences in conversational speech. On the sentence production task all of their sentences were grammatical and contained coordinated and subordinated clauses. They used more words on average per sentence and took a significantly shorter time to formulate the sentences than the learning disabled students. The learning disabled students used an average of five words in their longest sentences in conversational speech and with few exceptions the form was simple declarative. They produced 19 agrammatical sentences and all but four of their grammatically correct sentences were simple declarative.

On the subtests assessing speed and accuracy of performance, the normally achieving adolescents obtained a significantly higher score in a shorter time on the test of antonyms, and they recalled significantly more names of class members than the learning disabled group within the 60 seconds allowed. On the picture naming task, the learning disabled students took significantly longer than the normally achieving students and made significantly more errors.

Overall, the learning disabled adolescents exhibited a significant reduction in the accuracy and speed with which they recalled verbal opposites, names of members within a class, and pictures of objects. The learning disabled students also demonstrated a reduction in the ability to formulate complex grammatical sentences and they took longer to formulate sentences relative to the normally achieving adolescents. The differences in performance between the groups suggest that the learning disabled students had difficulty with syntax and with word retrieval.

Differences in syntactical abilities between older learning disabled and normally achieving students were supported in a second study (Wiig, Semel, & Abele, 1981). On a task of perception and interpretation of ambiguous sentences, normally achieving 12 year old students interpreted lexical and syntactical ambiguities more accurately and completely than 12 year old learning disabled students. The performance of the 12 year old learning disabled students was comparable to the performance of 7-8 year old normally achieving students on the interpretation of lexical ambiguities, and to the performance of 5-6 year old normally achieving students in interpreting the syntactical ambiguities in the sentences.

In one of the few studies which were found on younger students,Vogel (1977, 1983) examined the use of morphological rules in 7-8 year old normally achieving and learning disabled students. The learning disabled students developed control of morphological structures much later than the normally achieving students. Bryen (1981) also observed that learning disabled children had difficulty with syntactic forms. She reported that learning disabled children have difficulty with pronoun usage, especially the use of pronoun referents which is a critical skill for understanding discourse.

Narrative Recall and Comprehension and Learning Disabled Students.

Most of the studies which were found on narrative recall and comprehension involved older students. There were few studies where narrative skills in younger learning disabled students were compared with those of younger normally achieving students. The areas examined in the studies varied but they can be categorized as story grammar knowledge, propositions recalled, use of cohesive devices and linguistic skills. In general, each study focussed on one or two of these categories.

Smiley, Oakley, Worthen, Campione, and Brown (1977) investigated the recall and comprehension of seventh grade good and poor readers for two unfamiliar fairy stories in both a listening and a reading condition. Comprehension was assessed as the relevance of the recalled information to the text. Students wrote the recalled versions of the stories.

The good readers recalled more information than the poor readers and the information recalled was important to the structure of the story. The poor readers recalled less information and what was recalled had less relevance to the story. Third grade normally achieving students also recalled more information than the seventh grade learning disabled students, and were more sensitive to the important structural elements in the text. A comparison was made between the learning disabled students' recall performance and that of an entire room of 21 first grade students. The grade one students listened to either one of the fairy stories and then retold it orally to a peer. Both the learning disabled students and the first grade students demonstrated low levels of recall and only differentiated between the most important structural elements in the stories.

The results appear to indicate that the seventh grade learning disabled students did not apply story grammar knowlege appropriately to assist recall and comprehension of the stories. The results should be interpreted cautiously because the grade seven students were required to write the recalled versions of the stories. There are no indications in the study that writing difficulties were controlled for during the selection of the seventh grade learning disabled students. The differences between the students may have been confounded by writing difficulties in the learning disabled students.

Hansen (1978) also involved older students in a narrative recall task. She found significant differences in the percentage of actual propositions retold, the ability to relate main ideas, and comprehension, between fifth and sixth grade learning disabled and normally achieving students. Students read aloud two passages from the Durrell Analysis of Reading Difficulty (Durrell, 1955) then retold the stories and answered literal questions about them. The learning disabled students answered fewer questions correctly and recalled fewer propositions from each reading passage than the normally achieving students. Fewer of the propositions recalled were superordinate suggesting that the learning disabled students did not activate story grammar schema to assist recall. There was a significant correlation between the percentage of actual propositions recalled and scores on comprehension for each group on both reading passage. Caution needs to be exercised in interpreting Hansen's (1978) findings because her results were based on the use of a read-aloud measure.

Liles (1985) involved younger students in her study and found that there were no differences between language learning disabled students and normally achieving students ranging in age from 7 to 10 years in the factual comprehension of a film they had just viewed, but there were differences in inferential comprehension. The language learning disabled students comprehended less about the story grammar than the normally achieving students. Differences were also found in linguistic skills. The language learning disabled students used significantly more incomplete cohesive ties and significantly fewer sentences than the normally achieving students.

Merritt and Liles' (1987) findings on comprehension supported the findings of Liles (1985). Merritt and Liles (1987) compared the performance of 10 year old normally achieving and language learning disabled students for the retelling of a story they had just heard on a video, and for answering factual questions, and questions about the story grammar. There was no difference between the language learning disabled students and the normally achieving students for factual comprehension but differences were found for the comprehension of questions about causal relations expressed in the story. The language learning disabled students answered significantly fewer questions correctly about causal relations.

The differences extended to the retelling of the narrative. The normally achieving students retold significantly more story grammar components, produced significantly more complete episodes, and used significantly more main and subordinate clauses than the language learning disabled students.

In a comprehensive cross sectional and three year longitudinal study, Feagans and Short (1984) examined the relationship between skills in oral narrative recall and comprehension, IQ, and reading achievement in younger school age children. Participants, six and seven year old learning disabled and normally achieving students listened to a story containing 10 events and then enacted it using toy props. When the story was acted out without a mistake the props were removed and the students were asked to retell it. Recall protocols were analyzed to determine the number of events remembered and the number recalled out of sequence, the number of words and the number of utterances used, the proportion of complex utterances, and the proportion of nonreferential pronouns used. Non verbal comprehension was established as the number of trials needed to act out the story without error.

Cross-sectional results demonstrated that there was no difference between the groups on the comprehension measure and no difference on the temporal ordering of the events. Significant differences were found in retelling. The children with learning disabilities recalled fewer action units, used fewer words overall, and proportionately more non referential pronouns. The differences were maintained over the three year period of the study. The children with learning disabilities continued to produce fewer action units, fewer words and more non referential pronouns; they also used fewer complex sentences.

A moderate correlation was also established between several discourse measures and IQ and reading achievement across the three years of the study. Full scale IQ correlated with the total number of words in the first two years ($r= .42$ and $.48$; $p< .01$) and trials to criterion and production in the third year, (r= -.55 and .48; p <. 01).

Feagans and Short (1984) concluded that the differences between the learning disabled and normally achieving students on the narrative recall could not be due to poorer comprehension of the narrative because there was no difference between the groups on nonverbal comprehension. The implication is that story schema was appropriately activated to assist comprehension. The authors concluded that the difference was most likely due to a verbal deficit in the learning disabled group.

Graybeal's (1981) findings appear to contradict the conclusion by Feagans and Short (1984) that a verbal deficit was the most likely cause of the difference in narrative recall between learning disabled and normally achieving students. Graybeal (1981) ensured that language learning disabled students could process the story material at a single sentence level first but she still found recall differences between normally achieving students and language learning disabled students. Participants, aged 7-9 years listened to and retold two stories. Recall protocols were analyzed into propositions based on the relative accuracy of each proposition, and organization of recall.

The major difference between the groups on the retelling was in the amount of information recalled. The language learning disabled students recalled significantly less than the normally achieving students. The groups performed similarly on the temporal organization of recall and on the inclusion of plausible information and the exclusion of errors. The language learning group simply recalled less than the normally achieving group.

The results suggest that even when language effects are controlled language learning disabled students continue to perform differently to normally achieving students on narrative recall. Graybeal (1981) speculated that the differences in recall between the normally achieving and the language learning disabled students may have been due to memory difficulties in the language learning disabled.

Summary of narrative recall and comprehension.

1. Narrative recall and comprehension can be best understood within the domain of schema theory.

2. All knowledge is stored in the form of units known as schemata. Schemata are active processes which assist in comprehension and recall of information. Story grammar knowledge is a specific form of schemata used in the comprehension and recall of narratives.

3. Linguistic knowledge is also an integral part of narrative recall and comprehension.

4. Traditional studies of language skills generally involved comparisons between older rather than younger learning disabled and normally achieving students.

a) Learning disabled students used simple declarative sentences rather than complex sentences, more agrammatical sentences and fewer words than normally achieving students. They processed syntactical and lexical ambiguities at a level much below that expected for their chronological age, and they evidenced delayed onset in their use of morphological forms. The use of pronoun referents was observed to be problematic.

b) Differences in word retrieval skills between the groups of students included the amount of time taken and the accuracy of recall. Learning disabled students were slower and less accurate than normally achieving students on tasks which required them to name pictures and antonyms, and to recall words within a given category.

6. In studies of narrative recall and comprehension:

a) Results generally indicated that learning disabled students were differentiated from normally achieving students by the amount of information recalled.

b) They produced fewer complete cohesive ties, used more non referential pronouns, fewer complex sentences, and fewer words than normally achieving students.

c) There were equivocal findings about comprehension; some investigators found differences in literal comprehension, some found no differences in literal comprehension but differences in inferential comprehension. In one study no difference was found on non verbal factual comprehension. The comprehension tasks differed from study to study making it difficult to generalize findings across studies.

d) There was no difference between learning disabled students and normally achieving students for the temporal ordering of recalled information.

Statement of the Problem

The review of the literature demonstrated that general and specific models of information processing provide a framework for examining the cognitive processes that underlie the performance of learning disabled students. In the studies of specific processes, learning disabled children were differentiated from normally achieving children on the following:

1) The efficient use of verbal rehearsal skills.

2) The response to various types of distractors. Although learning disabled children were not found to be inherently distractible, they were differentiated from normally achieving children in their response to various types of distractors.

3) They made more errors of omission and commission on vigilance tasks and demonstrated a decrement in performance.

4) They demonstrated syntactical errors, used fewer complex sentences, and fewer words on traditional language tasks. They also took more time to retrieve words and were less accurate in word recall.

5) On narrative tasks they recalled less information. Findings on comprehension were equivocal but they organized the sequence of recall as well as normally achieving students.

Several factors emerged from the review.

a) The studies in the review for the most part involved a population of students defined as learning disabled. The selection of students was usually made on the basis of an ability/achievement discrepancy and achievement was measured by scores on reading /arithmetic tests.

b) Most of the studies involved older learning disabled students or students with a broad range of ages.

c) When cognitive processes were investigated the focus was usually on a unitary cognitive process.

d) Although an information processing approach to psychoeducational assessment may provide more information about how individual students learn than the present standardized tests of achievement and ability, there is at present not a widely accepted and well standardized procedure for assessing cognitive processes.

The study undertaken had the following purposes.

1) The first purpose was to to examine verbal rehearsal, selective attention, sustained attention, and oral discourse narrative recall and comprehension as they function dynamically in children with learning problems.

2) The second purpose was to examine these skills in students aged eight year~~s~~ defined as language learning disabled who were nonproductive in terms of the objectives of the curriculum.

3).The third purpose of the study was to examine the relationships between the tests in the test battery to determine if any of them could be used as screening measures of cognitive and linguistic processes.

3. METHODS AND PROCEDURES

In this chapter the methods and procedures used to examine verbal rehearsal skills, selective attention, sustained attention, and discourse narrative recall and comprehension in children identified with language disabilities and poor school achievement will be introduced. The test battery will be identified first, followed by a rationale for each of the tests used and a description of the test. In the absence of standardized tests of verbal rehearsal, sustained attention, selective attention, and discourse processes, tests were developed and/or adapted from the research. The methods and procedures will be described following the description of the test battery.

Test Battery

Many different aspects of attention, cognitive processing, and language could have been chosen for this study. In the interests of parsimony the choice was limited to only a few; verbal rehearsal skills, selective attention, sustained attention, and discourse narrative recall and comprehension. The choice reflected what the literature said about cognitive processing and language difficulties in learning disabled children as well as the clinical experience and interest of the author.

The test battery administered to the students was divided into two parts. The first part included tests which were used to identify the population, and the second part of the battery was used to collect data on selective attention, sustained attention, verbal rehearsal and narrative recall and comprehension.

Identification battery

1) Hearing screening (Department of Health & Welfare, Canada, 1982)

2) The Test of Language Development-2 Primary known as the TOLD-2 P (Newcomer & Hammill, 1988)

3) WISC R (Weschler, 1974).

Experimental battery

4) Verbal rehearsal (adaptation from Bauer, 1979)

5) Selective Attention-Receptive (attention) (Das, 1987)

4) Sustained Attention (attention) (adaptation from Das, 1987)

6) Narrative discourse recall and comprehension (adaptation from Feagans and Short, 1984)

Description of the Tests

Hearing Screening

A pure tone air conduction hearing screening was completed at 20 dbHL (re ANSI-1969) for 1000Hz, 2000Hz, 4000Hz, with input increased to 25 dbHL at 4000Hz if the tone was not heard (Department of Health & Welfare, Canada, 1982).

The TOLD-2 P (Newcomer & Hammill, 1988)

The TOLD 2 P was designed for children aged 4-0 to 8-11 years. It is based on a linguistic model of phonology, syntax, morphology, and semantics in both the listening and speaking modes. There are seven representative subtests for which standard scores are computed. Composite scores for syntax, semantics, phonology, listening, and speaking are also computed based on the scores of the subtests. The Spoken Language Quotient is formed from the scores of all seven subtests. Composite scores of 90-110 are in the average range; scores of 80-89 are below average and scores of 70-79 fall into the poor range.

The TOLD-2 P is a revised version of the TOLD P (Newcomer & Hammill, 1988). Reliability is reported for internal consistency, stability, and standard error of measurement with clear evidence of good reliability for five of the seven subtests. Questions remain about the internal consistency of the Picture Vocabulary and Grammatic Understanding subtests, and the Listening composite score (Allen, 1985). Content, criterion related, and construct validity are also reported for the earlier versions in the test manual. The relationship between the TOLD 2 P and school readiness and achievement was established in six studies with highly significant correlations in all cases (Newcomer & Hammill, 1988).

WISC-R

The WISC R was administered to all students by a certified psychologist prior to the study. Full Scale scores, Performances Scales and Verbal Scale scores were computed. The Freedom from Distractibility factor was obtained from the sum of the scaled scores on Arithmetic, Digit Span, and Coding

Verbal rehearsal

There were no standardized tests of verbal rehearsal skills available. A free recall task which allowed for the indirect examination of primacy and recency effects was developed specifically for this study based on the tasks used by Bauer (1979) (see Appendix B). Four lists of nine words each, totalling 36 words were selected from the Thorndike-Lorge (Thorndike & Lorge, 1944) list of 10, 000 words most likely to occur for children. The words were drawn from the first 1, 000 words in importance. The lists were formed so that there was low semantic and phonemic intra list association (Bauer, 1979). Monosyllabic words only were included. Words were presented in a monotone at the rate of one per second. Scores were tallied for the total number correct across all four lists. The average number correct for the first three serial positions and the last three serial positions across the four trials was used to estimate the primacy and recency effects respectively.

Selective Attention

There were few tests of selective attention available. Selective Attention-Receptive (attention) was chosen from a battery of tests under development by the Psychological Corporation which will be published within the Cognitive Assessment System (Snart, Das, & Mensink, 1988). The directions provided by Das (1987) were rigidly adhered to. There are two forms to the test but only Form A was used. Here the child has to find and underline first picture pairs that look alike (physical match) and then picture pairs that represent the same object (name match). Scores are recorded as time in seconds to complete the task, and the number of items correct. The alpha reliability is .83 based on 80 children from the third to the fifth grade (Snart, Das, & Mensink, 1988). Timing the operations is related to the view that the efficiency of mental operations can be measured by the time that is required (Posner, 1973). Form A begins with a practice session during which the child practices the physical matching task first followed by the name matching task. When the child completes the practice sessions successfully the test begins.

Sustained attention

There were few standardized tests of sustained attention available. Sustained Attention (attention), the test chosen, is a vigilance task in experimental form and under development by the Psychological Corporation (Das, 1987). It has a low cognitive demand requiring only the monitoring of a consistent stream of auditory stimuli in which randomly occurring critical stimuli are embedded. The possibility that performance would be confounded by the cognitive load of the task was thus reduced by the low cognitive demand of the task. The primary factor in the task is the voluntary control of the attentional processes over a sustained period of time (Krupski, 1980).

Specific directions were not available for the administration of the test therefore a form was developed for this study (see Appendix A). The child participating in the task was required to identify a pair of words (the critical stimulus) by listening to an audiotape recording of a list of boy's and girl's names. The signal "Pete" followed by "Liz" was embedded within a random repetition of four boy's names and four girl's names. One name was presented every two seconds and six signals occurred during each two minute period over a 10 minute period for a total of 30 signals. The child identified the signal "Pete, Liz" by tapping the table. The score was the total number of signals identified correctly. For the purpose of this study the scores were divided into three intervals of 10 responses each in order to observe possible decrement in attention over time. The alpha reliability for this test was .72 based on 83 children in grades 3 to grades 5 (Snart et al, 1988).

Narrative skills

No standardized narrative recall tasks were found which could be included in the test battery and so an adaptation of the narrative task used by Feagans and Short (1984) was developed for the study (see Appendix C). The major difference between the task used by Feagans and Short (1984) and the one developed for the present study was the design of the comprehension measure. Feagans and Short (1984) used a nonverbal measure of comprehension in which the participants acted out the story with the use of props. In the present study comprehension was assessed by asking the participants questions about the story. This was felt to be a more appropriate measure of comprehension than a non verbal measure since teachers frequently use questions to assess understanding.

The participants were told to listen to a brief story introduced by a theme and read to them by the investigator, so that they could retell it immediately. There were 10 action units (marked by superscript in Appendix C) and 96 words in the story. Following the presentation the children retold the story. Their retelling was audiotaped for later analysis. They were then asked ten comprehension questions, nine of which related to eight action units in the story and one related to the theme which set the context for the story. Protocols were analyzed for linguistic complexity of the output, narrative content, and temporal ordering of the action units. The following specific measures were obtained; a) the number of action units recalled in the paraphrase; b) the total number of words (Appendix C); c) the proportion of complex utterances (Appendix C); d) the proportion of non referential pronouns (pronouns with no concrete noun referent in the previous part of the narrative) and e) the number of action units out of sequence. The data derived from this task included five error analysis measures which called for a reliability check.

Method

Two groups of children, an experimental group of language learning disabled children and a normative group of regular grade two children were established for data collection. It was necessary to establish a normative group because standardized norms were not available for the experimental tests used in the study. The study began after the central administration of the Edmonton Public School District and the Ethics Review Committee of the Department of Educational Psychology University of Alberta reviewed a written proposal and gave permission for the study to proceed. The Principals of eight schools from one sub division in the Edmonton School District who were identified in the proposal were then visited personally by the investigator and the proposal was discussed with them. All of the Principals gave permission for the study to be conducted in their respective schools.

Following this, teachers of grade two students in the eight schools were contacted personally by the investigator and the study was explained to them. All were given the option of not participating but all chose to participate. Three grade two teachers from one school agreed to select regular grade two children from their classes for participation in the normative study.

A similar procedure was followed for gathering parental consent for both groups of students. When potential subjects were identified by teachers the investigator verified that the students fit the identification criteria established for the study. The identification criteria is discussed when the subjects are described in a following section. Letters of permission were then sent home with all students who met the established criteria. The letters described the purpose, usefulness, expected benefits of the study, the methods, time required, and confidentiality of the project. (See Appendix D). Parents were required to give written consent for their children to participate and for the investigator to access student records. Phone calls were also made to the parents by either the teacher or the investigator in order to answer any possible questions about the study.

Normative Study

Participants in the normative study were 20 grade 2 students, 11 female and 9 male from three classrooms in one suburban school in Edmonton. Age ranged from 86 months to 98 months, with a mean age of 93.05 months. The students were selected by their teachers as average students who did not demonstrate any particular academic difficulties or exceptional abilities. None of the children had any known organic, emotional, or sensory deficits. Parent consent was obtained by letter, and parents were informed by letter also when testing had been completed (see Appendix D for copies of letters). The tests of selective attention, sustained attention, verbal rehearsal, and narrative recall and comprehension were administered to provide normative data for use with the experimental population. Results are compiled in Appendix E.

Experimental Study

Subjects

Twenty students were selected from eight different schools located in one suburban district of Edmonton. All had been identified by their teachers prior to the study as students who were experiencing difficulty in terms of the specified curriculum. The school psychologist, and/or reading specialist, and/or speech and language pathologist confirmed the teacher's perceptions using criteria developed by the Edmonton Public School Board for identifying students with special needs. The criteria for students with less than three years of schooling included:

(1) Intellectual ability should fall within the range of dull normal to average on an individual intellectual assessment.

(2) A delay of 1.5 or more years (or below the third percentile for age) should be evident on three or more of the following "readiness" areas:

a) pre-reading skills (composite)
b) basic concepts
c) quantitative concepts
d) sight reading
e) expressive language
f) receptive language
g) visual motor integration (Edmonton Public Schools 1988).

To ensure that the sample population demonstrated language disabilities students who were selected for the study evidenced a delay in receptive language, and/or expressive language on the above criteria. The language disability was confirmed by the administration of the TOLD-2 P. All of the students scored below the average range on the Spoken Language Quotient (a composite of all the subtests). Sixteen of the 20 students scored either below average or within the poor range on the composites for syntax and semantics. Results are presented in Appendix F.

Results of the WISC R established that all of the students had average ability. Ten students evidenced a statistically significant 15 point spread between Verbal and Performance scores with higher Performance scores. An additional four students had a 14 point discrepancy between Verbal and Performance scores with higher Performance scores. Results are presented in Appendix G.
All of the students in the experimental study were from monolingual backgrounds and spoke English as a first language. No student had any known sensory, organic, neurological, or emotional disabilities which interfered with learning. Fourteen students were male and six were female with ages ranging from 85-107 months with a mean age of 97.05 months.

Procedure

Each child was seen individually in as quiet a room as could be arranged in the home school. Testing was completed in one session and lasted approximately 60 minutes. This time does not include the administration of the WISC R which was completed on a separate occasion, prior to the administration of the test battery. The order of presentation of the tests in the battery remained the same for each child. The identification tests were administered first beginning with the hearing screening and followed by the TOLD 2 P. All of the subjects passed the hearing screening indicating that difficulties were not related to poor auditory acuity and that testing could proceed. Because of its length the TOLD-2 P could not be scored during the testing session. As a result, two students completed the test battery but were excluded from the sample because their scores fell within the average range on the TOLD-2 P. All students in the final sample were below the average range on at least two composite scores on the TOLD-2 P.

The experimental tests were then administered in the following order:

1) Selective Attention-Receptive (attention) Form A, (Das, 1987)

4) Sustained Attention (attention) (adaptation from Das, 1987). Instructions developed by the investigator are presented in Appendix A.

5) Verbal rehearsal skills (adaptation from Bauer, 1979) Instructions developed by the experimenter are presented in Appendix B.

6) Narrative recall and comprehension (Adaptation from Feagans & Short, 1984). Instructions developed by the experimenter are presented in Appendix C.

Coding

Following the story retelling, each story was segmented into action units previously determined by Feagans and Short (1984). The total number of words, the total number of utterances, the proportion of complex utterances, the proportion of non referential pronouns, and the action units out of sequence were calculated. See Appendix C for the guidelines used for coding.

Interrater reliability.

Interrater reliability checks were completed between the investigator and a qualified speech language pathologist for 11 of the 20 narratives (55% of the total) for the language learning disabled students for a total of 77 observations, and for 9 of 20 narratives (45% of the total) from the regular grade two students (55 observations). The guidelines used for coding the protocols are reported in Appendix C. There was 92.2% agreement on the narratives from the language disabled students and 94.54% agreements on the narratives from the regular grade 2 students. Those portions not agreed upon were reviewed using the guidelines until consensus was reached.

4. RESULTS

Two types of analyses were completed on the data. First, because standardized norms were not available for the experimental tasks of selective attention, sustained attention, verbal rehearsal, and narrative recall and comprehension, the performance of the language learning disabled children was compared with the performance of normative sample on these tests. Means and standard deviations were computed for both groups and *t* tests were completed to test for significant differences between them. Where standardized norms were available as was the case for the TOLD-2 P and the WISC R, these were used for comparison.

Secondly, correlational analyses were completed on the data from the language learning disabled students to explore the dynamic relationships between performance on the tests of linguistic and cognitive functioning. Correlations were also completed to explore the possibility of developing a screening battery of tests of cognitive and linguistic processes

Normative study

Means and standard deviations for the normally achieving children for selective attention-receptive (attention), sustained attention, verbal rehearsal, and narrative recall and comprehension, are summarized in Appendix E.

Language Learning Disabled Students

The TOLD-2 P and the WISC R were used for identification of the sample. Results are tabulated in Appendices F and G respectively.

Verbal rehearsal

Verbal rehearsal skills were inferred from primacy and recency effects on a free recall task. Primacy effects were calculated by taking the average of the total number of words recalled in the first three serial positions for the four lists. Recency effects were calculated by taking the average of the total number of words recalled for the last three serial positions for the four lists. Total recall scores were also calculated. On a *t* test of the difference between the means, there were significant differences between the normally achieving students and the language learning disabled students for total recall scores and for recall of the first three positions (primacy).

The normally achieving students recalled significantly more words overall, and more words from the first three positions (primacy effect) than the language learning disabled students. There was no difference between the groups for recall of words in the last three positions (recency effects). Results are shown on Table 1.

TABLE 1. Comparison between the means of the normally achieving and language learning disabled students for primacy and recency effects and for total recall scores on a free recall task.

	Language L D.	Normally achieving	T value
Total no. recalled	11.65	14.15	2.87*
Recency mean	1.93	1.98	.32
Primacy mean	.49	.93	2.81*

* significant at $p \leq .005$

Selective Attention-Receptive

On a t test there were no differences between the normally achieving students and the language learning disabled students on the physical matching portion of the test either for time taken to complete the task, or for the number correct. Results are presented on Table 2.

TABLE 2 Differences between the means of normally achieving and language learning disabled students for physical and name matching, selective attention

Test	Normally Achieving Means	Language Disabled Means	One Tail t Test
Sel. attention			
Physical match			
Trial 1			
Time	38.55	41.60	-1.25
No. correct	12.65	12.25	1.26
Trial 2			
Time	31.25	34.50	-1.54
No. correct	11.35	11.15	.64
Name match			
Trial 1			
Time	63.85	62.95	.21
No. correct	9.35	7.55	2.65*
Trial 2			
Time	52.20	47.95	1.15
No. correct	9.90	8.15	2.45*

* significant at $p \leq .02$

On the name matching portion of the test there was no difference between the groups on a t test for the time taken for matching pairs. Significant differences were recorded between the normally achieving grade 2 students and the language learning disabled students for the number correct on name matching. The normally achieving students matched significantly more name pairs than the language learning disabled students.

Sustained attention

Scores for sustained attention were recorded as total scores. Scores were also recorded for each of the three intervals of 10 responses each; the first 10 responses, the second 10 responses, and the final 10 responses. Errors of commission were also calculated. Findings are presented in Table 3.

Table 3. Differences between the means of normally achieving and language learning disabled students for sustained attention.

Test	Normally Achieving Means	Language Disabled Means	One Tail t test
Sus. attention Total	26.10	19.28	3.48*
Intervals 1-10	9.10	7.50	2.39*
11-20	8.55	6.15	3.43*
21-30	8.45	5.50	3.71*
Commissions	.25	2.25	-1.73

* significant at p≤ .02

On a t test of the difference between means, there were significant differences between the normally achieving students and the language learning disabled students for the total number of critical stimuli identified, and for the number identified during the first interval (1-10), the second interval (11-20), and the third interval (21-30). The normally achieving students in each instance identified significantly more critical stimuli than the language learning disabled students. There was no difference between the groups for errors of commission.

Narrative recall and comprehension

The results of the t test of the difference between means demonstrated that there were no significant differences between the normally achieving students and the language learning disabled students for the number of action units recalled, the number of words used in the recall, the number of utterances, nor for the temporal ordering of the action units.

There was a significant difference between the normally achieving students and the language learning disabled students for the proportion of complex sentences, and for the proportion of nonreferential pronouns used in the narrative recall. The normally achieving grade 2 students used significantly more complex sentences than the language learning disabled students and significantly fewer non referential pronouns. There was also a significant difference between the groups on the comprehension measure; the language learning disabled students answered significantly fewer questions correctly than the normally achieving students. Mean number correct for each group was 7.770 (SD 1.432) for the normally achieving students and 5.750 (SD 1.293) for the language learning disabled students. [t (4.173)=0.000, $p \leq 0.02$]. Results are presented on Table 4.

Table 4. Differences between the means of the normally achieving group and the language learning disabled group on narrative recall and comprehension.

Task	Lang. L D. Means	Normally Achieving Means	One Tail t Test
No. of action units	3.55	4.50	1.28
No. words	39.32	54.35	1.76
No. utt.	4.80	4.90	.13
Prop. complex sentences	20.95	36.65	2.23*
Prop. non ref. pronouns	23.00	3.30	-2.41*
Action units out/sequence	.65	.30	-1.19
Comprehension	5.75	7.55	4.17*

significant at p< .02

Correlational Analyses

Correlational analyses were completed on the data for the language learning disabled students from the test battery. Significance was set at $p \leq .02$ for all of the analyses.

The findings from the correlations were classified into four groups for examination and are reported using the same organization.

1) Linguistic processes

2) Attentional processes
3) Memory processes
4) Additional analyses

Linguistic Analyses

TOLD-2 P and WISC R

In the present study no significant relationship was found between the TOLD-2 P, the Full Scale (r=.046, p=.846), Performance Scale (r= .183, p=.440), or the Verbal Scale (r= .056, p=.816) from the WISC R for the language learning disabled group.

WISC R and composite scores on the TOLD-2 P

No significant relationships were found between the WISC R Full Scale, Performance Scale, or Verbal Scale, scores and either the syntax or semantic composites on the TOLD-2 P. Results are presented in Appendix H.

WISC R and subtests of the TOLD-2 P

The WISC R Full Scale, Performance Scale, and Verbal Scale scores were compared with the scores for the subtests on the TOLD-2 P. The only significant relationship found was between Grammatic Understanding (TOLD 2 P) and the Full Scale score (r= -.518,; p= .019).

WISC R and narrative recall and comprehension

No significant relationships were found between any measures of narrative recall and comprehension and the WISC R Full Scale, Performance Scale, or Verbal Scale scores. Results are presented in Appendix I.

TOLD-2 P Spoken Language Quotient and the short form of the TOLD 2 P

Newcomer and Hammill (1988) reported that a short form of the TOLD-2 P could be derived from the sum of the scaled scores of the subtests Picture Vocabulary and Grammatic Completion, and that this form could be used when a quick estimate of overall language ability was required. The subtests chosen for the short form were the two most valid subtests that would yield the highest correlation with the composite Spoken Language Quotient (SLQ). In the present study the relationship between the short form of the TOLD-2 P and the Spoken Language Quotient was non significant (r= .406; p=.076).

TOLD- 2 P and measures of narrative recall:

Based on clinical experience it was anticipated that there would be a relationship between scores on the TOLD-2 P and items from the narrative recall because both tests measure linguistic elements. No significance was found for any relationships except for a relationship between the phonology composite score made up of word articulation and word discrimination, and the proportion of complex sentences used (r=.529; p= .016).

Attentional Processes

Freedom from Distractibility (WISC R) and Selective Attention

No significant relationship was found between the Freedom from Distractibility factor and the measures of selective attention. Results are presented in Appendix J.

Freedom from Distractibility and Sustained Attention

There was no significant relationship between the Freedom from Distractibility factor and the measures of sustained attention. Results are presented in Appendix J.

Total Score for Sustained Attention and interval scores

There was a significant relationship between the total score for sustained attention and the scores for each of the intervals. For the first interval r=.819; p= 0.00. For the second interval r=.968; p= 0.00 and for the third interval r= 898 p= 0.00. There was a significant relationship between the first interval and the second interval, (r =.743; p= 0.00) and a near significant relationship between the first interval and the third interval (r= .512; p= 0.021); the second interval was correlated with the first (r=.743; p=0.00) and with the third (r=.860 p= 0.00)

Measures of Selective Attention

There was a significant correlation between the time taken on the second trial of the physical matching condition on selective attention and the time taken on the second trial of the name matching condition (r= .643; p= .002). There was also a significant relationship between the number of items correct on the first trial of the name matching condition and the number correct on the second trial of the name matching condition (r= .635; p= .003). The time taken for the second trial in the name matching condition correlated significantly with the number of items correct on the second trial in the name matching condition (r= .542; p= .014).

Memory

Digit Span (WISC R), the total score and primacy effects on the verbal rehearsal task

The relationship between the total number of words recalled and the Digit Span was non significant (r= .204; p= .389). The relationship between Digit Span and primacy effects was also non significant (r= .254; p= .280).

Freedom from Distractibility (WISC R) and total score and primacy effects on the verbal rehearsal task

No significance was found for the relationship between the Freedom from Distractibility factor and the total recall score on the test of verbal rehearsal (r= .248; p= .292)or between the Freedom from Distractibility factor and primacy effects (r=.245; p=.297). Results are presented in Appendix J.

Additional Analyses

Comprehension of the narrative and the number of action units

No correlation was found between comprehension of the narrative and the number of action units recalled by the language learning disabled students (r= .225; p= .340).

5. DISCUSSION OF RESULTS

Performance of the Language Learning Disabled Students

Verbal Rehearsal and Language Learning Disabled Students

There were differences between the performance of the normally achieving students and the language learning disabled students on the verbal rehearsal task. The language learning disabled students recalled significantly fewer words overall, and significantly fewer words from the first three positions representing the primacy effect. There was no difference between the groups for recall of the last three positions representing the recency effect.

The difference in primacy effects between the groups suggests that there were differences in the use of verbal rehearsal. On free recall tasks such as the task in the present study, recency items, those which are presented last to the participant, are recalled from short term store and have had little rehearsal. Primacy items, those which are presented first, are presumed to have been rehearsed longer and are recalled from long term store (Bauer, 1977, 1979).

The lack of a difference between the groups for recency effects supports Bauer's (1977) findings that the memory problems of learning disabled students were not due to a difference in short term store. Bauer (1977) concluded that the learning disabled students in his study attended to information in immediate memory but they did not rehearse the information long enough to transfer it into long term store. If the findings from the current study are interpreted in the light of Bauer's (1977, 1979) conclusions the language learning disabled students attended to the items in short term store and recalled them as well as the normally achieving group. The difference between the groups was in the use of verbal rehearsal processes. The normally achieving students demonstrated a greater primacy effect than the language learning disabled students, suggesting that the language learning disabled students did not use verbal rehearsal skills as efficiently as the normally achieving students.

Tarver et al. (1976), and Torgesen and Goldman (1977) also demonstrated differences in verbal rehearsal between young learning disabled and young normally achieving children. However, most of the studies which were found examined verbal rehearsal in older students. In addition, the sample populations in most of the studies were learning disabled students selected on the basis of an ability /achievement discrepancy in reading and/or arithmetic. The results of the present study extend the findings to young language learning disabled children. It appears that differences in verbal rehearsal between normally achieving students and language learning disabled students occur at an early age.

Verbal rehearsal is fundamental to other memory processes. If information is not rehearsed it decays rapidly and further processing does not take place (Atkinson & Shiffrin, 1968, 1971). Maintaining information through rehearsal provides the opportunity for elaborative processes to operate and thus increases the strength of the memory trace (Craik & Lockhart, 1972). If rehearsal processes are not efficient then the storage and retrieval of information will also be inefficient. This implies that the language learning disabled students will be differentiated from normally achieving students in the acquisition of a verbal knowledge base.

Although the present study indicates that there was a difference in verbal rehearsal use between the language learning disabled students and the normally achieving students it does not indicate the underlying cognitive base for these differences. Tarver et al. (1976) demonstrated that the difference could be due to a "maturational lag". Torgesen and Goldman (1977) demonstrated that the difference could be at a metacognitive level evidenced in the failure to activate rehearsal strategies where appropriate. Further research is necessary to determine at which level or levels of cognitive functioning the difference in verbal rehearsal skills between the language learning disabled students and the normally achieving students occurred.

Selective Attention and the Language Learning Disabled Students

There was no difference in the performance of the normally achieving students and the language learning disabled students in selective attention when the task was to match pairs of stimuli that looked the same. Both groups of students took the same amount of time to complete the task, and they identified an equal number of similar pairs. There was a difference in the performance of the groups for selective attention when the match was based on similar names and the physical appearance was different. Both groups took the same amount of time to complete the name matching task but there was a significant difference in the number of pairs they identified. The young language learning disabled students identified significantly fewer pairs in the name matching condition than the young normally achieving students.

The results demonstrate that differences in selective attention between normally achieving children and language learning disabled children are present in young students. Most of the studies which were found involved comparisons between older learning disabled students and normally achieving students. However, Samuels (1967) demonstrated that young reading disabled children were more distracted by picture stimuli than young normally achieving students. Samuels students were reading disabled. The results from the present study extend Samuel's (1967) findings to young students who are language learning disabled.

It appears that the differences in attending selectively between the normally achieving students and the language learning disabled students were not due to inherent attentional deficits in the language learning disabled students. The language learning disabled students demonstrated that they could attend as well as the normally achieving students when the pairs of stimuli were matched on the basis of physical similarity. The differences in attention occurred when the the match was based on similar names but the physical appearance was slightly different. The language learning disabled students responded differentially to the physical and name clues.

The results support Krupski's (1986) position that attention is best conceptualized as an interaction between the demands of the task and the characteristics of the individual rather than as an inherent characteristic of the individual. There was no difference in performance between the groups of students when the task did not include a language component. Both groups were equally adept at processing physical stimuli. The difference occurred when the task included a language component as it did on the name matching condition. The language learning disabled students identified fewer pairs than the normally achieving students in the same amount of time. There are several possible explanations as to why the language learning disabled students produced less.

First, the concept of timing operations is related to the view that efficiency of mental operations can be measured by the time required for the task (Posner, 1973). Therefore timing how long it took to match pairs of stimuli was an attempt to measure the efficiency of the mental operations involved. There was no difference between the groups for the time taken on the task but the language learning disabled students produced fewer matching pairs.

It appears that the naming task was a difficult task for the language learning disabled students. The literature supports the position that learning disabled students are slower on naming tasks than normally achieving students. Wiig and Semel (1975) for example found that learning disabled adolescents exhibited a significant reduction in both the accuracy and speed with which they recalled the names of objects and the names of items within categories in comparison to normally achieving adolescents.

The results of the present study do not indicate why the naming task was difficult. There are several possibilities. Sternberg (1980, 1984) identified the ability to recognize the nature of a problem as an essential element of successful performance. Several language learning disabled students appeared to have difficulty with this aspect of the task. Despite having completed practice sessions successfully prior to the test for both physical and name matching conditions they indicated by their comments during the name matching task that they were continuing to look for a physical match.

The difference in naming might also have been due to a deficit in the performance components. On the name matching task this could have occurred at the encoding level, or when attempting to compare the stimuli with previously encoded stimuli, or when making a decision about the appropriateness of the comparison.

Differences might also have been related to speed of processing semantic information. The language learning disabled students may have processed semantic information at a slower rate than the normally achieving students. Copeland and Reiner (1984) suggested that the difference in time taken between normally achieving students and learning disabled students on a speeded classification task was due to the slower processing of the learning disabled students and not to differences in selective attention. It is possible that what appeared to be a difference in selective attention between the normally achieving and language learning disabled students may have been a difference in the speed of processing semantic information.

Sustained Attention and Language Learning Disabled Students

Responses on the test of sustained attention were measured for omission and false alarm rate (commissions). Decrement in performance (reduction in performance over time) was not measured. Differences were found between the normally achieving students and the language learning disabled students for omissions but not for commissions. The language learning disabled students made more errors of omission than the normally achieving students.

The results are in agreement with previous findings that learning disabled students made more errors of omission on vigilance tasks than normally achieving students. Most of the studies with the exception of Swanson's (1983), reported results for a broad age range of students. Swanson (1983) examined errors of omission at discrete ages for 8, 10, and 14 to 15 year old boys and found that errors were more prevalent for learning disabled boys than normally achieving boys at all ages. The present findings are in agreement with Swanson's (1983) findings that young learning disabled students are differentiated from young normally achieving students on tasks of sustained attention. The results also suggest that the findings of differences between learning disabled and normally achieving students on tasks of sustained attention can be extended to include language learning disabled students.

There was no difference between the language learning disabled students and the normally achieving students for errors of commission. Thus there was no agreement with studies which indicated that students with learning handicaps including learning disabilities exhibit more commission errors than normally achieving students (Krupski, 1980, Swanson, 1983). Douglas and Peters (1979) suggested that errors of commission were indicative of impulsivity and were a characteristic of hyperactive children. A failure to find a difference between the language learning disabled students and the normally achieving students for commission errors on the vigilance task suggests that the language learning disabled students were no more impulsive than the normally achieving students.

Decrement in performance was not measured but there were indications that the performance of the language learning disabled students deteriorated relative to the performance of the normally achieving students. A perusal of the mean scores for both groups (see Table 3) indicates that the performance of the language learning disabled students continued to deteriorate from the beginning to the end of the task, whereas the performance of the normally achieving students stabilized from the second to the third interval.

Vigilance tasks are concerned with the volitional control of attention (Krupski, 1980) which is a metacognitive function. It is probable that the difference in performance between the language learning disabled students and the normally achieving students could have been due to differences at a metacognitive level of functioning. It is also possible that the differences could have been due to differences in other areas of cognitive functioning.

Failure to remember the identity of the critical stimuli is one possible source of differences. A memory probe was used during the test to check memory for the critical stimuli when students were having difficulty with the task. All of the students who were probed were able to remember the critical stimulus. Difficulty with the task did not appear to be related to memory problems.

The performance of one student illustrates the necessity of examining the cognitive bases to poor performance in the manner recommended by Sternberg (1980). This student was not able to identify any of the critical stimuli when the task was administered in the standard condition. A probe indicated that he knew what the stimulus was and what the task was. Further probing demonstrated that he could select the critical stimuli from the other stimuli when the investigator presented the stimuli but he was unable to identify the stimuli from the audiotape. The boy's difficulties with the task did not appear to be related to difficulties in sustaining attention, nor to problems in understanding the task, nor to memory problems. The performance of this student illustrates the need to develop assessment tasks which can help identify the underlying cognitive bases to poor performance.

Discourse Narrative Recall and Comprehension and Language Learning Disabled Students

The results of the narrative recall and comprehension task demonstrated that there were significant differences between the normally achieving students and the language learning disabled students for the proportion of complex sentences used, the proportion of nonreferential pronouns used, and on the comprehension questions. The language learning disabled students used fewer complex sentences and more nonreferential pronouns.

They also answered fewer comprehension questions correctly. There was no difference between the groups for the number of action units recalled, the number of words used in the recall, nor for the temporal ordering of the action units.

The syntactical differences between the normally achieving and language learning disabled students in the present study was predictable. Eighteen students in the language learning group had previously demonstrated below average to poor scores on the syntax composite on the TOLD-2 P (Newcomer & Hammill, 1988).

Most of the studies which were found focussed on linguistic differences between older learning disabled students and normally achieving students. Wiig and Semel (1975) demonstrated that learning disabled adolescents were distinguished from normally achieving adolescents by the use of simple declarative sentences rather than complex sentences. Linguistic differences between older students were found in narrative recall (Liles, 1985; Merritt & Liles, 1987). Bryen (1981) did not specify any age when she reported that pronoun reference is particularly problematic for language learning disabled students. Vogel (1977, 1983) and Feagans and Short (1984) found that younger learning disabled students were differentiated from younger normally achieving students on syntactical measures. The results of the present study support the findings of Vogel (1977, 1983) and Feagans and Short (1984) that there were syntactical differences between young normally achieving and language learning disabled students, and extend the findings to differences between young language learning disabled students and normally achieving students.

Differences were found between the normally achieving students and the language learning disabled students for the comprehension of the narrative. The normally achieving students answered significantly more factual questions correctly. With the exception of Feagans and Short (1984) who studied comprehension in six and seven year old children, differences between normally achieving and learning disabled children in comprehension have been reported in older children or in children with a broad age range. Hansen (1978) reported that fifth and sixth grade learning disabled students answered fewer factual questions correctly than normally achieving students. Liles (1985) found differences between normally achieving students and language learning disabled students ranging in age from 7 to 10 years for inferential comprehension but not for literal comprehension. Merritt and Liles (1987) extended Liles' (1985) findings to 10 year old children. Feagans and Short (1984) compared young learning disabled and normally achieving students on nonverbal comprehension and found no differences between the groups.

The conflicting findings about comprehension may be due to the different methods and procedures being used to test comprehension. Unless some agreement is reached about what to assess in comprehension and on methods and procedures for assessment, knowledge about comprehension in learning and language learning disabled children will remain haphazard.

The difference on comprehension found in the present study may have been due to differences in functioning at the metacomponential level manifested in a failure to apply schematic knowledge to the comprehension of the story. On the other hand the language learning disabled students may have an undifferentiated schema for linguistic elements, and /or story grammar knowledge, and/or background knowledge related to the story. As a result the students may not have identified and attended to relevant elements in the story and may have stored irrelevant information. The other possibility is that the students may not have been able to express the answers to the questions appropriately because of language disabilities. The point is that the differences in comprehension could be due to differential functioning in various components used in processing information.

In the present study literal comprehension was measured using an oral question and answer procedure. This method was presumed to represent the type of comprehension that is frequently and informally assessed by the teacher in the early grades in school. In a typical classroom the teacher gives information orally and then questions the students about their knowledge of the information.

The fact that the young language learning disabled students answered fewer comprehension questions correctly than the normally achieving students has implications for their performance in the classroom. Much information especially in the early grades is conveyed orally to the students by the teacher. Language is the medium used to convey the curriculum. Since the language learning disabled students did not comprehend the oral narrative as well as the normally achieving students in the testing situation, it is probable that they will not copmprehend information transmitted orally by the teacher, as well as normally achieving students.

Ultimately their school performance will be differentiated from that of normally achieving students.

No difference was found in the present study between the young normally achieving students and the young language learning disabled students for the temporal ordering of information. Feagans and Short (1984) recorded a similar finding for young learning disabled students. Graybeal (1981) also found that there was no difference between seven to nine year old language learning disabled students and normally achieving students on the temporal ordering of recalled narratives. Both groups of students organized recall in a similar manner. From this it could be inferred that the schemata applied to the story recall by the normally achieving and the language learning disabled students were sequentially organized.

The results from the present study conflicted with the findings of Feagans and Short (1984) in several instances. Feagans and Short (1984) found that the learning disabled students used fewer words than the normally achieving students. In the present study no difference was found. In addition, the normally achieving students and the learning disabled students in Feagans and Short's (1984) study produced more words than any of the students in the present study. Feagans and Short (1984) reported in the crossectional findings that the 7 year old normally achieving students produced an average of 76.19 words (S.D. 29.90) and the 7 year old learning disabled students used an average of 68. 00 (S.D. 28.95). Normally achieving 8 year old students in the present study used an average of 54.35 words (S.D. 28.25) and the 8 year old language learning disabled students used an average of 39.2 words (S.D. 26.10).

Feagans and Short (1984) also found that the young learning disabled children recalled fewer action units than the normally achieving children but in the present study no difference was found between the groups. In general the studies reviewed also demonstrated that learning disabled and language learning disabled students recalled fewer propositions than normally achieving students (Smiley at al. 1977; Hansen, 1978; Graybeal, 1981 and Merritt & Liles, 1987).

The conflicting findings on the recall of action units, the number of words used, and the comprehension measure, between Feagans and Short (1984) and the present study may be an artifact of the different procedures used in the studies rather than a difference in performance between the students. In particular, familiarity with the story and the investigator over the three year period in Feagans and Short's (1984) study may have differentially affected the learning disabled and the normally achieving students in the original study. In the present study, the students were not familiar with either the story or the task. However the language learning disabled students had an unfair advantage over the normally achieving students. The language learning disabled students were familiar with the investigator and were comfortable in an individual testing situation whereas the normally achieving students were new to the investigator and were unfamiliar with a one on one testing situation. These variables may have contributed to the finding of "no difference" between the groups. Future investigations should include practice stories prior to the administration of the test items to familiarize both sets of students with the task, the setting, and the investigator.

The conflicting findings between Feagans and Short's (1984) study and the present study on the number of words used may not indicate differences in linguistic skills. A total tally of the words used in a complete retelling is not necessarily a valid measure of linguistic competence. Wiig and Semel (1975) found that normally achieving adolescents used more words per sentence than learning disabled adolescents but the measure was for words at the sentence level and not for total words used. Bryen (1981) reported that learning disabled students tended to use simple sentences and more words in place of more complex sentences which required fewer words overall. In the present study several language learning disabled students produced a rambling type of discourse in which they used many more words to express ideas that were expressed succinctly by other students. Thus the findings of differences in words used can be discounted as a measure of linguistic complexity.

One question remains about why there were differences between the normally achieving students and the language learning disabled students in the present study for comprehension but not for recall. Hansen (1978) found a significant correlation between comprehension and the percentage of propositions retold for both learning disabled and normally achieving fifth and sixth graders. No correlation was found in the present study. The answer might lie in the performance of the normally achieving grade 2 students in the present study. Perhaps their lack of familiarity with the examiner and their lack of experience in a one on one testing situation inhibited their performance on the recall measure but not on the comprehension measure which was a more familiar task. Future studies could address this issue by providing practice sessions for story retelling before the actual test begins.

Correlational Analyses

The second part of the study involved a correlational analysis of the data from the test battery for the language learning disabled students to determine what relationships existed between the tests. The tests included; the WISC R (Wechsler, 1974), TOLD-2 P. (Newcomer and Hammill, 1988), Selective Attention-Receptive (Das, 1987), Sustained Attention (Das, 1987) Verbal Rehearsal (adapted from Bauer, 1979) and Narrative Recall and Comprehension (adapted from Feagans & Short, 1984). The analysis was undertaken as a preliminary step towards the development of a screening battery of tests of linguistic and cognitive processes.

Linguistic Analyses

Correlations between the Spoken Language Quotient of the TOLD-2 P the Full Scale score, the Performance Scale, and Verbal Scale scores of the WISC R were examined to determine if scores on the WISC R might predict the Spoken Language Quotient of the TOLD-2 P. No correlations were found. Nor was there any correlation between the Full Scale, Performance Scale, and Verbal Scale scores on the WISC R and the syntactic and semantic quotients of the TOLD-2 P. The only correlation was between Grammatic

Understanding, a subtest of the TOLD-2 P and the Full Scale score of the WISC R. There was also no correlation between the Full Scale scores, the Performance Scale scores, and the Verbal Scale scores of the WISC R and the narrative discourse measure used in the study. The results indicate that for the language learning disabled population in this study the WISC R was not a good predictor of general linguistic competence as measured by the TOLD 2 P.

The failure of the WISC R to predict performance on the TOLD-2 P. conflicts with other findings. Wong and Roadhouse (1978) reported a significant relationship between the Spoken Language Quotient of TOLD-2 P and the WISC R Full Scale, Performance Scale, and Verbal Scale scores, for second and third grade normally achieving, speech delayed, reading disabled students, and another group consisting of a combination of students from the three other groups. The only score that did not reach significance in Wong and Roadhouse's (1978) study was the relationship between the Verbal Scale on the WISC R and the total score on the TOLD 2 P for the reading disabled group. In contrast to the present findings the implication from Wong and Roadhouse's (1978) study is that performance on the TOLD-2 P could be predicted from results on the WISC R for reading disabled, speech delayed, and normally achieving students.

The results of the correlational analyses in the present study for a population specifically defined as language learning disabled indicated that performance on the WISC R did not predict performance on the TOLD-2 P. The findings from Wong and Roadhouse's (1978) study should not be extended to include language learning disabled children similar to the population in the present study. The WISC R should not be used to predict linguistic competence in populations of language learning disabled students. A separate linguistic measure should be included on a test battery.

Correlations were also examined between the WISC R and the scores on the narrative recall and comprehension but no significance was found, indicating that the WISC R did not predict performance on the discourse measure for the language learning disabled students in the present study. Feagans and Short (1984) reported a significant correlation between Full Scale IQ (WISC R) and the total number of words used by the reading delayed children in the first two years of their study (r= .42 and .48), and between the Full Scale score and trials to criterion and production (number of action units recalled) in the third year of the study (r= .55 and .48). The relationship between the number of words used and the Full Scale WISC R. (r= .237; p=.314), and the relationship between the number of action units recalled and the Full Scale WISC R were not significant in the present study. The conflict in findings between the present study and Feagans and Short's (1984) study suggests that the different procedures used in the two studies produced different results.

With the exception of a correlation between the phonology composite score and the proportion of complex sentences used no correlations were found between the discourse measure and the TOLD-2 P indicating that a measure of discourse distinct from the TOLD-2 P and the WISC R should be included in a battery of tests.

Newcomer and Hammill (1988) indicated that a short form of the TOLD-2 P. could be used in research studies to replace the full length version of the test. Thus it seemed possible that the short form could also be used in a screening battery to replace the long form of the test. The results of the correlational analyses indicated otherwise. No correlations were found between the Spoken Language Quotient of the TOLD-2 P and the short form of the test. Thus the short form of the TOLD-2 P is not a substitute for the long form when the population is similar to the language learning disabled students in the present study.

Attentional Processes

The Freedom from Distractibility factor on the WISC R did not correlate with any of the measures of attention used in the study. Sattler (1988) described the factor as a global measure and hypothesized that a low score is related to; "difficulty in sustaining attention, distractibility, anxiety, short- term retention deficits, encoding deficits, poor rehearsal strategies, difficulty in rapidly shifting mental operations on symbolic material, and inadequate self monitoring skills " (p. 174). In the present study the Freedom from Distractibility factor did not predict performance on any of the tests of attention for the language learning disabled students. Therefore it could not be included in a test battery as a predictor of sustained attention and selective attention as defined in this study. Further research is necessary to determine if the factor can predict other measures of attention.

On the test of sustained attention, correlations were found between the full score on sustained attention and the scores for each of the three intervals. This result suggests that a short version of the test of sustained attention would be a satisfactory predictor of the longer version of the test and could be substituted for it in a test battery. A note of caution is necessary here. Differences between the normally achieving students and the language learning students were not computed for decrement in performance. A possible decrement was observed in the performance of the language learning disabled students relative to that of the normally achieving students. An examination of the mean scores for each interval for each group (see Table 3.) suggests that there was a decrement in the scores for the language learning disabled students which is not apparent in the mean scores for the normally achieving students. Although the scores for the first interval correlated with the scores for the second interval for the language learning disabled group, the scores for the first interval did not correlate with the scores for the third interval, suggesting that there was a difference in performance. Prior and Sanson (1986) suggested that tests of sustained attention need to be at least 30 minutes long in order to account for decrement in performance as a result of time on task. An abbreviated form of sustained attention cannot account for decrement in performance which occurs over a period of time. Thus an abbreviated form is not recommended for a test battery. Also, further statistical analysis is recommended to determine if the perceived decrement in the performance of the language learning disabled students differentiates them from normally achieving students.

The tests of selective attention examined two conditions for which selective attention is required. One condition involved the processing of physical stimuli and the other condition involved the processing of semantic information. Performance was measured by time taken to complete each trial of each task, and by the number of items correct on each trial.

Although correlations were tabulated within and across conditions, time and number correct on one trial did not correlate in any instance with time taken and number correct on another condition or trial. Thus the correlations were not comprehensive enough so that performance on one pair, including time taken and number correct, predicted performance on another pair.

In addition, the division of selective attention into processing physical stimuli and processing semantic information provided useful information about how language learning disabled children attend differentially to physical stimuli and to semantic stimuli, relative to normally achieving children.

No correlations were found between any of the measures of selective attention and any of the measures of sustained attention. Presumably the tests of selective attention and sustained attention were measuring different aspects of processing and one could not be used to predict the other in a test battery.

The test of selective attention cannot be substituted by another test on the test battery. In addition, the complete test of selective attention is necessary because one part did not predict another part and because use of physical and name matching conditions provides an opportunity to examine differential functioning in selective attention.

Memory Processes

There were no correlations found between any of the tests of memory. Performance on Digit Span (WISC R) did not correlate with performance on the experimental test of verbal rehearsal. It should be noted however that the stimuli differed on these tests and that while the the digit span used numbers for recall the experimental test of verbal rehearsal utilized names of familiar items. The Freedom from Distractibility factor which Sattler (1988) believes to be based in part on proficiency in short term memory retention, verbal rehearsal processes,and encoding processes, did not correlate with the experimental test of verbal rehearsal. Thus, because one test of memory did not predict another test of memory in the current study it is not possible to substitute one test of memory for another in the test battery.

Summary of Discussion of Correlational Analyses

Correlational analyses were completed on data from the test scores of the language learning disabled students. The results indicated that for the language learning disabled students in the present study very few predictions of performance on one test could be predicted from the performance on another test or part of the same test.

In terms of predicting linguistic competence, the only prediction possible between the TOLD-2 P and the WISC R was that performance on Grammatic Understanding could be predicted from the Full Scale score of the WISC R. The resulting negative correlation indicates that when Grammatic Understanding as tested by the TOLD 2 P is high the scores on the WISC R will be low. The use of complex sentences as defined in the narrative measure could be predicted from the Phonology composite score on the TOLD-2 P. Neither of these linguistic measures provides sufficient information about overall language skills to be included in a screening battery of tests for linguistic and cognitive processing skills. Separate tests of ability, linguistic competence, and narrative discourse skills are recommended. In addition the short form of the TOLD-2 P is not recommended as a substitute for the complete TOLD-2 P.

The correlations between and across the measures of selective attention were not comprehensive enough to allow for the substitution of one measure for the other. Also, performance on the test of selection attention for physical stimuli compared with performance on the test of selective attention for semantic information provided useful information about how language learning disabled children responded differentially to distractors relative to normally functioning children. Both tasks should be included in a test battery. The tests of sustained attention used in the current study cannot be substituted for the test of selective attention.

Although there were correlations between the total score for sustained attention and scores on each of the three intervals on sustained attention there was a possible decrement in the performance of the language learning disabled students over time, relative to the performance of the normally achieving students. Further statistical analyses are necessary to explore this possibility. Tests of sustained attention that last for 30 minutes have been recommended for exploration of decrement in performance (Prior & Sanson, 1986).

No significant correlations were found between the tests of memory indicating that performance on one test of memory could not predict performance on another test of memory. The Freedom from Distractibility factor did not correlate with any measure of memory or attention used in the study. This factor at best appears to be a global measure of "distractibility" which provides little specific information about the cognitive bases to behaviour. It is possible that more specific information about memory and attention processes could be obtained through observation of the student's performance during the testing procedure, and from teacher reports and observations of the student's classsroom performance, than is obtained from the Freedom from Distractibility factor.

6. CONCLUSIONS

Cognitive and Linguistic Functioning

In this study there were three stated purposes: 1) to examine cognitive and linguistic processes as they function dynamically in children with learning problems; 2) to examine these processes in eight year old language learning disabled children; 3) to determine the possibility of using any of the tests or portions of the tests from the test battery for screening cognitive and linguistic processes.

The results of the study clearly demonstrated that differences in cognitive and linguistic processing were present between language learning disabled students and normally achieving students. The results also confirmed that the differences were present in young students.

The young language learning disabled students were differentiated from the normally achieving students on the use of verbal rehearsal skills. The difference in verbal rehearsal skills suggests that the language learning disabled students did not maintain information in short term store as efficiently as the normally achieving students. As a result, organization of information, deeper semantic processing, transfer to long term store, and ultimately the development of a rich knowledge base will be negatively affected.

There have been few studies which have focussed on memory processes in language learning disabled students of any age (Kirchner & Klatzky, 1985). The present results clarified that language learning disabled students as well as learning disabled students differed from normally achieving students in the use of verbal rehearsal skills. The results also indicated that differences in verbal rehearsal were present in young students, indicating that verbal rehearsal processes should be investigated in language learning disabled students in the early grades in school. Differences in verbal rehearsal skills may be a contributing factor to the students' low levels of school achievement.

There were also differences between the language learning disabled and the normally achieving students on the selective attention task indicating that these processes should also be investigated in young students. The differences were not present on all of the measures of selective attention, suggesting that the language learning disabled students were not characterized by an inherent attentional problem. Instead, attention varied with the task. The young language learning disabled students performed in a similar manner to the normally achieving students on the physical matching portion of the task but they performed differently when the task involved language skills.

The differential performance of the young language learning disabled students on the attentional tasks strongly suggests that attentional problems should not be regarded as a deficit which resides within the child. Instead, attentional problems in students should be addressed by examining the nature of the tasks in which the student is involved relative to the characteristics of the student. The difficulty with this position is that much of the learning that takes place in school involves language. Therefore students with language disabilities will have more difficulty than normally achieving students in selecting relevant information for processing in tasks that involve language.

The language learning disabled students were also differentiated from the normally achieving students on the sustained attention task. They made more errors of omission but they did not differ on commission errors. The findings on decrement were not analyzed statistically thus firm conclusions cannot be reported. The difference in sustained attention in such young students has to be given serious consideration in the educational context because most classroom tasks involve some degree of sustained attention (Krupski, 1980). If students cannot maintain attention to tasks long enough to complete them, learning in school will be seriously impaired. Sustained attention is the ability to maintain attention to stimuli that have been selectively attended to. It is irrelevant that students attend selectively if they do not voluntarily maintain attention to the stimuli that they have selected.

There were also differences between the normally achieving students and the language learning disabled students on the narrative recall and comprehension measure. The young language learning disabled students used fewer complex sentences and more nonreferential pronouns than the normally achieving students. This finding is well supported in the literature on older learning disabled students (Wiig & Semel, 1975, Wiig et al, 1981) and was expected in the present study because as a group the young language learning disabled students evidenced syntactic and semantic difficulties on the TOLD-2 P.

The language learning disabled students answered significantly fewer comprehension questions correctly than the normally achieving students. Although the findings on literal comprehension are equivocal in the literature (Hansen, 1978, Liles, 1985, Merrit & Liles, 1987) the fact that differences were found between the students in the present study has implications for performance of the language learning disabled students on school tasks. Since most information is presented orally in the classroom, the language learning disabled students will likely process oral information less efficiently than the normally achieving students. The result will be poorer performance on classroom tasks.

The results also confirmed the expectations of the investigator and the teachers of the language learning disabled students that there would be differences between the normally achieving students and the language learning disabled students on the experimental tests of cognitive processes. This lends a degree of validity to the experimental tests.

The results of the study failed to demonstrate a dynamic relationship between performances on the tests of cognitive and linguistic processes for the language learning disabled students. The lack of correlations between the data from the tests of verbal rehearsal, selective attention, sustained attention, narrative recall and comprehension, as well as the WISC R and the TOLD-2 P indicates that it was not possible to predict the performance of the language learning disabled students in one area of cognitive or linguistic functioning from performance in another area. It cannot be assumed that when the performance of a language learning disabled student is low on one cognitive process, performance will also be low on other cognitive processes.

Similarly, the lack of correlations between the tests and/or portions of the tests demonstrates that one test or part of a test cannot be subtituted for another in a screening battery of cognitive and linguistic processes. For this reason none of the tests from the battery is recommended for screening linguistic and cognitive functions.

Individual Differences

In the exploratory study undertaken, results were reported as group means and standard deviations for each task. The reported means did not necessarily represent the performance of the majority of the language learning disabled students. Variability was a more noticeable feature for them than it was for the normally achieving students. Examples of means and standard deviations for both the normally achieving students and the language learning disabled for sustained attention are presented in Table 3. Variability within the language learning disabled students was almost twice that of the normally achieving students on some of the tests administered.

Krupski (1980) reported that there was more variability in performance for groups of learning handicapped children including learning disabled children, than for normally achieving children. She observed that wide variability is probably the most distinctive feature of any diagnostic category and that students within a diagnostic category tend to be more unalike than they are alike.

The variability in the performance of the language learning disabled students implies that the children in the sample performed differently to one another. It is thus inappropriate to assume that all of the language learning disabled students were differentiated from all of the normally achieving students on all of the tasks of verbal rehearsal, selective attention, sustained attention, and narrative recall and comprehension. Even though group differences were found on cognitive and linguistic processing, within the groups individual differences have to be taken into account in interpreting the results.

Limitations of the Study.

The study involved a small but specific sample of grade 2 students in the Edmonton Public School District who were identified as non achieving in terms of expectancy for their chronological ages and average ability levels. They evidenced a language disability which was not secondary to neurological, emotional, sensory deficits, or to second language learning. The findings are limited to a similar population.

The experimental nature of the tests needs to be taken into account in interpreting the results. The tests of selective attention and sustained attention are still in experimental form as part of a battery of tests of cognitive processes which is being developed by the Psychological Corporation (Das, 1987). The tests of verbal rehearsal and discourse processes were adapted from research by Bauer (1979) and Feagans and Short (1984) respectively. As a result reliability and validity were not established for the population for which these tests were used.in the present study.

One further caution is necessary in interpreting the results. The language learning disabled students were selected partly on the basis of non performance in the classroom. The temptation is to assume that lack of school progress for the language learning disabled students is related to the findings on the tests of discourse and cognitive processes. Although this may be so, the issue was not addressed in this study and therefore no causal claims can be made about the results.

Future Research

Differences were found in the present study between eight year old language learning disabled students and normally achieving students on experimental tests of verbal rehearsal, selective attention, sustained attention, and narrative recall and comprehension. Building on these findings future studies might:

1) explore whether the differences between the language learning disabled students and the normally achieving students on any or all of the cognitive processes tested persist over time.

2) examine the relationship between performance on each of the experimental tasks and reading achievement.

3) examine the relationship between the performance on the name matching condition of selective attention and tests of word retrieval.

4) examine the relationship between the performance on the name matching condition of selective attention and tests of semantic processing.

5) examine decrement in sustained attention for vigilance tasks of varying lengths.

6) develop intervention tasks for language learning disabled students related to each of cognitive processes tested and evaluate performance following a period of intervention.

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APPENDICES

Appendix-A

Sustained Attention (attention)

Materials. Tape recorder (Sony Cassette Corder TCM-141, volume setting 4), copy of tape of Sustained Attention. (Cognitive Assessment System)

Procedure Say to child, "I want you to listen to this tape. Listen to the boys' and girls' names. Every time you hear Pete and Liz together like this, Pete/Liz tap the table."(demonstrate by tapping the table). Repeat the instructions once.

Introduce the practice tape by saying. "The first part of the tape is a practice part." Play the tape for the child; replay if necessary until the child demonstrates understanding of the task by identifying the critical stimulus.

Continue with the test, listening to the tape with the child and scoring responses.

If five critical stimuli are missed or five stimuli which are not the critical stimuli are responded to, stop the tape momentarily and ask the child to tell you what he/she is listening for. If the child has forgotten the stimulus abandon testing.

Score correct responses in three sequences of 10 responses each; /10 /10 /10.

Count errors of omission (total score) and commission.

Appendix-B. Verbal Rehearsal.

Procedure. Tell the child; "I will read some words to you. Immediately after the last word tell me back as many of the words as you can in any order. (Repeat the directions once). Let's try some first. Listen carefully ...toy, hand, man, pen, soap, chair, bean, frog, hat." Wait for the child to repeat some of the words. When the child demonstrates by repeating some of the words that he/she understands the task introduce the test by repeating the instructions one more time.

"Listen carefully to these words...immediately after the last word tell me back as many of them as possible in any order."

Present the words to the child at the rate of one per second using a monotone voice; establish eye contact with the child during the task. Record responses on the protocol sheet.

rain--lip--six--car--band--fruit--leg--school--meat--

lake--jam--dog--class--snow--rest--clock--fish--noise--

tree--watch--age--cup--bone--ship--nest--hall--bag--

ice--cow--game--cloud--room--neck--boat--wall--rich

Total score

Recency score /3 (average score of last three items)

Primacy score /3 (average score of first three items).

Appendix-C. Narrative Recall and Comprehension

Procedure Tell the child;- "I am going to tell you a story. I want you to listen carefully so that you will be able to tell me back as much of the story as possible." Introduce the story by providing the following theme: *The story is about Mary who was having a surprise birthday party for her grandmother when she came home from work. Everyone was waiting at the house to surprise her while Mary ran out to buy food and equipment for the party.*

Instruct the child again; "Listen carefully so you will be able to tell me back as much of the story as possible."

Read the story using a normal rate of speech establishing eye contact with the child during the telling.

(Mary ran into the store to get the cake she had seen on her way to school) (When she looked at the cake she found that a piece was missing) (She looked all around the store but it was the only cake left.) (Mary cried.) (But there was nothing she could do, so she put the cake in her cart.) (Sadly she got some cups,) (and a tablecloth,) (and went home.) (Mary's grandmother was so surprised by the cake and other food that she clapped her hands.) (Mary was so happy she jumped up and down.)

At the end of the story turn on the tape recorder and tell the child, "You tell me the story now." If the child seems to be unable to start prompt once ,"Tell me whatever you can remember." Switch off the tape recorder and tell the child that you are going to ask some questions about the story.

Comprehension questions.

Whose birthday was it?
Why did Mary go to the store?
What was wrong with the cake?
How many other cakes were left in the store?

Did Mary buy the cake with the piece missing?
What else did she buy? _____
What else? ______
What did Mary's grandmother do when she saw the surprise?
How did Mary feel?
What did she do?

Score Production:
Number of action units: __________
Number of words: __________
Number of utterances: __________
Proportion of complex sentences: __________
Proportion of nonreferential pronouns. __________
Number of action units out of sequence __________
Score Comprehension
Number of questions answered correctly. _____/10__

Appendix C. Rules for Counting Words.

Contractions of subject and predicate like *it's* and *we're* are counted as two words.

Contractions of the verb and the negative such as *can't* are counted as one word.

Each part of the verbal combination is counted as a separate word.

Hyphenated and compound nouns are one word.

Articles, *the, a, an,* count as one word.

(Stickler, 1987, p. 68)

Appendix C Analysis of Complex Sentences.

Consider only sentences containing a dependent clause. These dependent clauses are embedded within the sentence and take a variety of forms including :

Infinitive clauses	I want to go.
Wh-clauses	I know what that is.
Relative clauses	The ones that have hats on are mine.
Full propositional complements	Pretend he's a monster.
Gerunds.	I felt like eating it.

Compound clauses are not to be considered complex. ie.clauses joined by a coordinate conjunction. (and, or, but,)

Subordinate conjunctions join clauses together to make them into single sentences; these include, because, if, whether, although, since, before, so, when, until.

(Stickler, 1987, pp 111-112; Lund & Duchan, 1988, p. 147).

Appendix D. Letter to Parents

Department of Educational
Psychology,
University of Alberta,
Edmonton, Alberta.
______1989.

Dear ________________,

I would like to request permission for your child ____________to take part in a research project which is related to my studies at the University of Alberta.

I am a speech language consultant in the Edmonton School District and work in your child's school. I am attempting to gain a better understanding of the relationship between language, memory, and attentional processes and how they affect children's learning in the classroom. I hope to be able to apply the knowledge gained from this project to the development of intervention programmes for children who have been identified as needing assistance. Your child's participation would greatly assist this process.

I will be working with a total of 20 children on an individual basis.in several schools. Each child will complete a battery of tests of memory, language, and attention administered by myself verbally. Reading and writing skills will not be involved. Hearing will be screened. Testing will be completed in one session and should take approximately 60 minutes. Information from previous test results on the school files will also be correlated with the present findings.

Your child will be identified by date of birth and sex, on the written study; names will not be used to protect privacy. Results will be available to you and the school following the study.

I hope that you will agree to have your child participate in this study. Please complete the enclosed form giving your consent and return it to school tomorrow.

Thank you in advance for your assistance,

Yours sincerely,

I ____________________(mother/father/guardian),give permission for my child ____________________to take part in the above study.

I also give permission for ____________________'s school records to be accessed by Mrs.Cossar,the student researcher and for information from previous tests to be included in the present study. Information is to remain anonymous on the written findings of the study.

Signed ________________________ Date______________

Appendix D. Letter to Parents of Normally Achieving Children

Department of Educational Psychology,
University of Alberta,
Edmonton, Alberta.
March 2nd., 1989.

Dear ________________,

I would like to request permission for your child to take part in a research project which I am completing as part of my studies at the University of Alberta.

As a speech language consultation with the Edmonton Public Schools I am attempting to gain a better understanding of attention, memory, and language processes. In order to do this I need to understand how children who are not experiencing difficulty in school perform on specific tests of memory and attention and language. I am requesting permission for your child as a regular grade 2 student at ______school to be involved in this preliminary study.

A total of 20 children will complete measures of memory, attention, and story retelling and comprehension. They will listen and respond to information on a tape, select similar objects from a visual array, remember a series of words, retell a story, and answer questions about the story. Individual testing should take no more than 30 minutes for each child and will occur in school during a regular school day. There will be a minimum amount of disruption to your child's school day.

When testing is finished average scores will be computed for all 20 students. These scores will be compared with the scores of students who are having difficulty in school. At no time will your child's name or individual score be used unless you yourself request information.

I hope that you will agree to have your child participate in this study. Please complete the enclosed form giving your consent and return it to school by Wednesday, March 8th.

Thank you in advance for your assistance,

Yours sincerely,

Olive Cossar.

I agree to have my child take part in the above study.

Signed____________________(Mother/father/guardian)

Date.______________

Appendix D. Letter of Thanks to Parents

Department of Educational Psychology,
University of Alberta,
Edmonton, Alberta.
1989.

Dear _________________,

Thank you for allowing your child to take part in the research project I am conducting related to my studies at the University of Alberta. Testing has been completed for your child but I am continuing to test the remaining students. When all of the testing has been completed I will examine and interpret the results for all the students and will be prepared to share the information about your child's performance with you at that time. Please contact me at 435 6539 if you have any questions or concerns about the tests.

Yours sincerely,

Olive Cossar.

Appendix E.. Means and Standard Deviations of Tests of Selective Attention, Sustained Attention, Verbal Rehearsal, Narrative Recall and Comprehension for Normally Achieving Students.

Sel. attention	Mean	Std.
Condition 1		
Physical match		
Trial 1		
Time	38.55	6.66
No. correct	12.65	.67
Trial 2		
Time	31.25	5.36
No. correct		
Condition 2	11.35	1.04
Name match		
Trial 1		
Time	63.85	10.02
No. correct	9.35	1.23
Trial 2		
Time	52.20	8.45
No. correct	9.90	1.77
Sustained attention		
Total correct	26.10	4.88
Interval 1-10	9.10	1.65
Interval 11-20	8.55	1.79
Interval 21-30	8.45	1.90
Commissions	.25	.44
Verbal rehearsal		
Total no. recalled	14.15	2.62
Recency effects	1.97	0.49
Primacy effects	0.92	0.50

Appendix E (continued)

Means and standard deviations of narrative recall and comprehension for normally achieving students.

Narrative	Means	Std.
No. action unit	4.50	2.37
No. words	54.35	28.25
No. utterances	4.90	2.38
Prop. complex sentences	36.65	24.89
Prop. non ref. pronouns	3.30	6.04
Action units out of sequence	0.30	0.47
Comprehension	7.55	1.43

Appendix F. TOLD-2 P. Composite Scores and Spoken Language Quotients for the Language Learning Disabled Students

SLQ	LISTEN	SPEAK	SEMAN	SYN	PHON
94	102	88	79	96	109
88	117	73	70	76	109
76	89	68	76	70	94
89	89	90	85	81	109
80	87	77	76	72	103
88	96	83	76	85	109
70	89	58	70	76	73
92	100	87	85	91	103
78	76	82	82	87	70
93	94	93	85	83	118
77	87	72	70	74	97
88	96	83	82	81	109
80	83	80	85	70	97
86	91	83	79	79	109
79	79	82	82	74	91
80	83	80	79	79	91
78	83	77	82	76	85
81	96	72	85	81	85
83	85	83	91	83	82
88	102	78	106	85	79

Appendix G WISC R Results: Language learning disabled students

Full Scale	Verbal	Performance Scores
96	91	102
89	78	105
95	85	108
87	80	96
88	75	105
87	72	108
82	73	95
91	86	100
82	77	91
91	86	100
87	88	88
91	88	96
84	81	88
84	78	92
83	72	98
99	85	115
92	88	100
99	91	108
86	73	104
97	92	104

Appendix H. Correlations between WISC R. Full Scale, Verbal Scale, and Performance Scale scores and the Spoken Language Quotient (SL Q), Semantic and Syntactic Composite scores and individual subtests on the TOLD 2 P

WISC R	Full Scale	Verbal	Performance Scales
TOLD-2			
S L. Q.	.046	.056	-.183
	(.846)	(.816)	(.440)
Semantics	.081	-.202	.067
	(.734)	(.393)	(.780)
Syntax	.269	.248	-.282
	(.251)	(.293)	(.228)
Subtests			
Picture Voc.	.087	.192	-.123
	(.717)	(.418)	(.605)
Oral Voc.	.473	-.108	-.202
	(.035)	(.650)	(.394)
Gram. Understd.	-.518*	.121	-.088
	(.019)	(.610)	(.713)
Sent. Imitation	-.032	-.059	-.155
	(.892)	(.8[illegible])	(.514)
Gram. Completion	.397	-.352	.024
	(.083)	(.129)	(.921)
Word Disc.	-.122	.121	.152
	(.610)	(.612)	(.524)
Word Ass.	.052	-.028	.049
	(.828)	(.905)	(.838)

Note: items in brackets are p values

For all correlations significance was set at $p \leq .02$

* Significant at $p \leq .02$

Appendix I. Correlations between WISC R. Full Scale, Verbal Scale, and Performance Scales, and Narrative Recall and Comprehension

WISC R.	Full Scale	Verbal	Performance Scales
Narrative recall and comprehension			
No. of action units	.480	-.192	-.145
	(.032)	(.418)	(.541)
No. of words	.237	-.018	.020
	(.314)	(.941)	(.934)
No. of utterances	.241	.014	-.030
	(.306)	(.952)	(.901)
Prop. complex sent.	.328	-.031	-.127
	(.157)	(.895)	(.594)
Prop n/r. pronouns	.196	-.212	.313
	(.407)	(.370)	(.180)
Action units out of sequence	-.130	-.194	.108
	(.585)	(.412)	(.652)
Comprehension	.143	-.370	-.097
	(.547)	(.108)	(.683)

Note: Items in brackets are p values.
Significance was set at $p \leq .02$.

Appendix J. Correlations between Freedom from Distractibility, Selective Attention, Sustained Attention and Verbal Rehearsal.

Sel attention	Freedom from Distractibility	
Condition 1		
Trial 1		
Time	-.416	(.068)
No. correct	-.246	(.296)
Trial 2		
Time	-.068	(.775)
No. correct	.270	(.250)
Condition 2		
Trial 1		
Time	.174	(.463)
No. correct	.318	(.171)
Trial 2		
Time	.256	(.276)
No. correct	.170	(.473)
Sustained attention		
Total	.023	(.923)
Intervals		
1-10	.334	(.150)
11-20	.006	(.979)
21-30	-.193	(.415)
Commissions	-.303	(.195)
Verbal rehearsal		
Total	.248	(.292)
Recency	-.089	(.708)
Primacy	.245	(.297)

Note: Items in brackets are p values.
Significance was set at $p \leq .02$.